PRACTICAL SANITATION

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A HANDBOOK FOR HEALTH OFFICERS AND PRACTITIONERS OF MEDICINE

BY

FLETCHER GARDNER, M. D.

CAPTAIN MEDICAL CORPS, INDIANA NATIONAL GUARD; FIRST LIEUTENANT MEDICAL RESERVE CORPS, UNITED STATES ARMY; HEALTH COMMISSIONER OF MONROE COUNTY, INDIANA,

AND

JAMES PERSONS SIMONDS, B. A., M. D.

PROFESSOR OF PREVENTIVE MEDICINE AND BACTERIOLOGY, MEDICAL DEPARTMENT, UNIVERSITY OF TEXAS; LATELY SUPERINTENDENT, INDIANA STATE LABORATORY OF HYGIENE.

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HARVEY WASHINGTON WILEY, M.D., Sc.D.,

Whose Services to the Cause of Sanitation

Need No Encomium,

This Book is Respectfully Dedicated

By the Authors

PREFACE.

This book was designed to fill a vacancy in literature. Up to the present, there has never been a serious endeavor to provide within the covers of a single moderate-priced volume, a plain, non-technical exposition of the duties of the health officer, written by one experienced in the routine and emergencies of the local sanitary service and familiar with the needs of the local health officer. It is compiled from many sources, and, while it contains much of the personal observation of both authors, it is perforce comparatively unoriginal, since it must present the established views and methods in combating disease and not ideas of the future. It aims simply to provide a safe way for the health officer to meet any emergency which may arise. Since sanitary officials in small places out of the reach of libraries are most in need of such a work, and since they are illy paid, the authors have endeavored to provide a book at a moderate price. Hence, much that is of interest to the expert has been excluded, while much that to him is axiomatic has been included.

Since treatises on tropical diseases are not ordinarily to be found in small libraries, several of these diseases not now known to occur in the United States, but which are capable of dissemination here, are included.

The parts of this book dealing with Epidemiology and General Sanitation are the work of Dr. Gardner, with the exception of the chapters on Milk and Water, which, with Part III, are the work of Dr. Simonds.

If this volume aids the health officer in solving his problems, and assists him in raising the standard of the public health, it will fulfill the one desire of the authors.

December 1, 1913.

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INTRODUCTION.

By J. N. Hurty, M.D.

Health Commissioner, State of Indiana.

Public and personal health are certainly prominent in the public mind to-day, and they well may be. It is plain that the future belongs to the nation which has the greatest proportion of healthy, strong citizens; hence, the national and State governments are deeply interested in preserving and improving the public health. The individual also, is now keenly alive to the fact that only through health may efficiency with success be attained; therefore, he too, is deeply interested.

Hygiene is the science, through the practical application of which public and personal health may be secured, and all eyes are turned toward hygiene. Sanitary science is a branch or department of hygiene. Its part is to secure, in a thorough and economical manner, ventilation, water supply, sewage disposal, drainage, waste disposal, and all the conditions which hygiene requires for health. Personal hygiene teaches the care of the body which is necessary in order to keep well and to strengthen the constitution. It has been found through experience that it is not enough simply to teach hygiene, but in some degree it must be forced; and therefore, laws requiring hygienic conditions are necessary and have been enacted in all advanced States. The more progressive States have very comprehensive laws which relate to every phase of public health protection, and make liberal appropriations for their execution and enforcement. Such States are reaping the good fruits of their wisdom.

The United States Public Health Service is doing a great work in the cause of public health throughout the country. Already, in quite all the States, it has been active in the matter of applied hygiene. In California and the other Pacific Coast States, it has strangled and put out bubonic plague; in Washington and other States it has successfully combated typhoid fever; it has fought off yellow fever from the Gulf States; it has done and is now doing

a mighty service against hookworm and trachoma in the Southern States. In a sense, it may be truly said that hygiene is building the Panama Canal; for it is certain that had she not been evoked to fight yellow fever and other diseases, the United States would have been driven away as was France in her day. A list of the States would be long, which are now through efficient Boards of Health conducting successful campaigns for the public health.

Consumption is slowly retreating before the onslaught of hygiene, and diphtheria and typhoid fever are in rapid retreat. Smallpox has been reduced to an almost negligible quantity, and the attack of hygiene, through medical inspection of school children, upon the defects and ills which beset them, will, without doubt, bring large returns in health and efficiency.

The foundation of all intelligent hygienic work is vital statistics. Vital statistics—the bookkeeping of humanity—furnish the only means of knowing the whereabouts of disease and the extent of the losses caused by it. They also tell our social latitude and longitude on the sea of time, which the nation must know if it is to endure. From these facts we learn that we must know the location and the strength of the enemy—Disease, before we can hope to combat it successfully. The first step for the successful conduct of a movement for the betterment of the public health is the collection of correct vital statistics, and therefore let every person do his part and see to it that the births, deaths and contagious diseases which occur in his family are reported.

This book treats of public and personal hygiene, entering into details and discussing their many features. Its teachings are true and to date, and it may be confidently stated that if its directions and lessons are heeded, the efficiency, wealth and happiness of the commonwealth will be greatly augmented.

PRACTICAL SANITATION.

PART I.

EPIDEMIOLOGY.

Foreword.

Epidemiology is that phase of sanitary science which treats of the causation, symptoms, and methods of prevention of the epidemic and endemic infectious diseases. It searches for the mode of transmission of disease, and endeavors to break the link between the present case and any possible future case. To do this it employs quarantine (absolute or modified), inspection of suspects, vaccination, laboratory diagnostic methods, clinical observation, and disinfection.

Different epidemiologists differ in their estimates of the value of the various sanitary measures, and the necessary means employed may differ in the hands of the same man with time and place. Since this book is written largely for the busy practitioner, who for the public good gives his time to the work of sanitation, and who has neither the time nor the opportunity to weigh the relative merits of different measures in times of epidemic, the means herein recommended will be those that are found safest and so far as possible are simplified so that the lay health officer or school official may understand. While the text is condensed, it is intended to be full enough to contain the essentials of diagnosis and the needful steps to be taken on the discovery of an epidemic or infectious disease.

It must be understood that the classification employed is in no sense based on pathology, and only to a limited extent on etiology; the only factors entering into it being the avenues of infection and the methods of prevention.

Such a classification appears somewhat unnatural when viewed

from the standpoint of pathology or medical practice, but should be an aid to the sanitarian in clarifying his views of the modes of infection. It is also to be understood that such an arrangement must be purely tentative, since advancing knowledge will compel transfers from one class to another, but for the present it is probably as good as any other.

CHAPTER I.

INFECTIOUS PROCESSES.

THE NATURE OF INFECTION.

Infectious processes are always the result of the growth and multiplication of some definite living organism. This infective agent may be bacterial, as in diphtheria and typhoid fever; protozoal, as in malaria and sleeping sickness; or of unknown nature, as in smallpox and a constantly diminishing group of diseases. Other higher groups of animal and vegetable organisms may also be of importance to the sanitarian, as the well-known hookworm and ray-fungus, but for the purposes of this chapter will not be considered. Every case of infectious disease is connected with a previous case, and unless the chain is broken by proper precautions, will be connected with a series of later cases. Infection never has been observed to arise *de novo*. A short resumé of the sources of infection and its modes of transmission follows:

SOURCES OF INFECTION.

Outside the Body.—The number of diseases whose virus is enabled to exist outside the body of a living host for more than a short time is small. Such germs are subjected to the effects of heat and cold, of desiccation, and especially of light, which is fatal to bacterial life (except the spores) within a few hours at most, provided that the layer containing them is sufficiently thin to allow the light to penetrate to the bottom. Of course, this statement does not apply to laboratory cultures, which are artificially placed in conditions simulating as closely as possible those within the body of the host. The two organisms best able to support an indefinite existence outside the body of a host are anthrax and tetanus, both of which are spore-bearing. Typhoid bacilli, the spirilla of cholera, the germs of both bacillary and amebic dysentery, and possibly the cocci of Malta fever are able to support a precarious existence outside the body, usually decreasing rapidly

in number and virulence, owing to overgrowth by saprophytic organisms, as well as the causes named above.

Carriers and Missed Cases.—In overlooked mild cases of disease and in carriers we find in all probability the explanation of most outbreaks of epidemic disorders. We know beyond peradventure that typhoid fever, Asiatic cholera, diphtheria, malaria and other diseases whose exciting cause is capable of exact demonstration are carried about by recovered cases and people who are not known ever to have had the disease. Sanitarians who have had experience in fighting scarlet fever, smallpox and measles know that their hardest problem is to search out and isolate the mild, scarcely recognizable cases. It is at least worthy of thought that these diseases of unknown etiology may have carriers in good health as do the diseases whose etiology is known. No successful anti-epidemic work can be done that fails to take into account carriers and mild cases. It must not be forgotten that carriers may give off the germs intermittently, as is surely the case in typhoid fever. This feature also puts limits to the value of isolation, and makes strict isolation early in an epidemic much more valuable than later.

Contact.—This may be *immediate* or *mediate*. Immediate contact is the direct touching of the sick and the well, with transference of the disease germs to the latter. Mediate contact presupposes a person or an object interposed between the sick and the well. If a surgeon contracts erysipelas from an operation wound, it is immediate contagion; if by his hands or instruments another person is infected, it is mediate contagion. Chapin justly states that it is the most obvious method of transmitting disease. But it is to be remembered that the obvious is not always the true explanation, and that more accurate knowledge may compel a revision of the diseases now placed here. For instance, fifteen years ago yellow fever would without hesitation have been placed in this class, yet it is now definitely known to have a secondary life cycle in the mosquito and never to be contagious. A more modern instance is typhus fever which is, according to accumulating evidence, only transmitted through the body louse. On the other hand, typhoid, which was only a few years ago thought to be almost wholly water-borne, is now known to be in a great proportion of cases contracted through contact.

Fomites.—This form of infection is like that of mediate contact, with the exception that a greater period of time is supposed

to elapse between the infection of the fomites and its transmission to the person infected. Only a few years ago it was supposed to be one of the most important modes of infection, but modern methods have narrowed and restricted its importance until at present only a very few diseases, such as smallpox, scarlet fever, typhoid fever and a few others are believed to be possibly transmissible in this way, and these but rarely. Tetanus and anthrax, having spore-bearing bacilli as their cause, are not at all infrequently communicated by fomites; but non-spore-bearing organisms are rapidly killed by adverse influences, or lose their virulence, or are not present at any time in sufficient numbers to have any effect. In the future, fomites will occupy the attention of the sanitarian less and less, and greater attention will be given to other modes by which infection may be transmitted.

Air.—Aerial transmission of disease has for long been an established dogma in the eyes of the laity and a large part of the medical profession, yet the evidence for an aerial convection of disease except in dust or in droplets of saliva or bronchial secretion coughed out by the sick, is nil. A number of germs, notably those of typhoid fever, dysentery, Malta fever, diphtheria, tuberculosis, anthrax, and the pus organisms may be conveyed in dust, and any of the infections in which the mouth and throat are involved as diphtheria, tuberculosis, pneumonia, influenza and others are known to be conveyed by the droplets expelled from the mouth in sneezing, coughing, and speaking. This is very certainly (although the assertion cannot be proved) the ordinary method for the communication of measles, scarlet fever and the other exanthemata, including smallpox.

Water.—This is a very common medium for the transmission of typhoid, cholera, and dysentery of both types; and there is a certain amount of evidence that sewage infected water may contribute to swell the incidence of tuberculosis. It may be infected at the source or at any other place where it is handled or stored before it reaches the consumer. There is a tendency for the water-bacteria, the action of light, and sedimentation, to kill out pathogenic bacteria; but a point is quickly reached beyond which these agencies cannot go, if the influx of infected material is large, and especially if it is accompanied by large quantities of sewage or other organic matter. Improvement in the purity of a water supply is always accompanied *pari passu* by improvement in the public

health. In the tropics, where Americans drink boiled water quite as a matter of course, they are much more free from the above named diseases than the natives who drink raw water, although almost all of the preparation of food and drink is done by natives. The sanitarian finds as his first duty that he must secure a water supply free from contamination, or failing that, must educate the people to boil, adequately filter or otherwise sterilize the water they use, and money spent to this end is wisely employed.

Food.—The diseases noted as water-borne are also food-borne and in addition diphtheria, scarlet fever and possibly other infections are transmitted in food—especially in milk. The infection of milk is almost always secondary, occurring after it has been drawn from the cow. Diphtheria of the cow's udder has been definitely proved in two instances to cause epidemics, and the milk of infected goats is the normal source of infection for Malta fever. Bovine tuberculosis is also transmitted to man through the medium of milk, but in all probability more rarely than is usually believed. Diarrheal diseases, though of uncertain bacteriology, are often communicated through the milk supply, the infection occurring after the milk is drawn.

Insects.—The list of diseases known to be transmitted by insects is growing large and is ordinarily fairly easy to handle from a sanitary standpoint, for the reason that insects can be seen and sought out and by proper methods destroyed wholesale. To enumerate: Malaria is carried by the Anopheles mosquito; yellow fever by the Stegomyia; dengue and filariasis by the Culex; Rocky Mountain fever and African relapsing fever by ticks; typhus and European relapsing fever by the louse and perhaps the bedbug; sleeping sickness by the tsetse fly; kala-azar by the bedbug, and evidence is accumulating that pellagra is carried by the buffalo gnat (Simulium). This list is likely to be added to rather than diminished, and in the instances named there is no other known mode of infection. The flea is the ordinary agent for the dissemination of plague, although contact infection is responsible for the pneumonic form. Flies, as noted in the special chapter devoted to them, are responsible for much infection—especially in places where garbage and night soil are badly handled.

Dosage.—The idea of dosage of infection is familiar to the bacteriologist, but less so to the man without laboratory experience. In working with pure cultures of known bacteria it has been found

that in order to kill animals of a certain species and weight, a certain minimum number of bacteria must be employed. It has also been found that almost all bacteria differ in virulence according to the source from which drawn and the method of cultivation. These two facts enable us to understand the occurrence of carriers and unrecognized cases of the infectious diseases, the explanation being either that the dosage has been insufficient to cause severe illness or the virulence too low to affect that particular person. Changed conditions causing lowered resistance on the part of the host or an increase in numbers or virulence on the part of the germ may convert a non-immune carrier into an active case, while other changes may kill out the organism and leave the host normal.

Great as have been the advances made in the last generation, only a beginning has been made in the study of the infections. In the future development of epidemiology, the local health officer who sees his cases in scattered communities where infection is more easily traced, must have an important part. By consultation with the highly trained men in the offices and laboratories of the State Boards of Health, and by careful searching out and study of the problems presented to him, he may be able to throw light on difficult and apparently insoluble problems. He should not forget that careful clinical observation is a guide and check to laboratory work, and should lose no opportunity to inform himself on this most difficult subject. Routine work done in a routine way will prove of no value to science, however valuable it may be practically to the community.

CHAPTER II.

THE MANAGEMENT OF EPIDEMICS.

Definition.—Epidemic is a term rather loosely applied to an unusual prevalence of any infectious disease. Strictly endemic diseases, such as tuberculosis, may present in a community at any time a number of victims which would greatly alarm the public if, for instance, smallpox or cerebrospinal meningitis—not to mention Asiatic cholera or bubonic plague—were present in the same degree, and any one of which would certainly be said to be in epidemic form.

General Principles.—The best way to manage epidemics is to avoid them and this is preëminently the aim of the sanitarian. That is to say, that with the first sporadic cases of any dangerous disease, immediately on the determination of their character, the health officer must with the utmost promptness quarantine and trace out all sick, contacts, and suspects, and carry out with them the appropriate measures of isolation, immunization, and disinfection. Energetically handled a situation often loses its threatening aspect almost at once. Publicity is a great weapon in such cases. The public will make light of the trouble in another place, but as soon as the dreaded disease appears at home it is usually willing to coöperate, provided it is thoroughly convinced that the danger is real. Publicity should not, however, go to the length of creating panic. It is always better to lay the emphasis on the means of defense against disease than on the danger. The average man has sufficient fear in the presence of an epidemic to make him exaggerate the risk beyond the actual.

If appropriations are to be asked from lay Boards of Health or City Councils, it is well to state frankly the worst of the dangers, and this is also necessary if the general public for any reason is indifferent to consequences and refuses to take the necessary measures to insure safety.

Established Epidemics.—Suppose the means above mentioned have failed? What measures are next to be adopted? The first

thing for the health officer to do is to arrange to give his entire time and attention to suppressing the disease. The second is to go to the treasurer in charge of the sanitary funds and ascertain how much of a balance is available for the work in hand. The third is to determine the amount which will probably be needed and secure an appropriation for the deficiency from the proper authorities. In arriving at this estimate he should ask himself what professional assistance will be needed for house and school inspection; for lay assistance; for disinfection; for rent or purchase of suitable quarters for a hospital and for subsistence and running expenses of the same; for nursing; for vehicles for inspectors and transporting patients, and so on. If the sum at his disposal is not sufficient for all these purposes, the health officer should determine which are least essential under the circumstances.

Maps.—Every health officer should be provided with a blueprint map of his territory on as large a scale as possible. No general would undertake a campaign without maps of the country in which he was to fight, and no health officer ought to undertake a campaign against disease without the same aid. Without it he cannot keep in mind the location of the various cases—especially with regard to their contiguity to churches, public halls, and schools. Colored pins, which may be bought in any dry goods store, are used for the record, thus: yellow, suspects and contacts; red, sick; white, recovered and disinfected; black, died. Small numbered and dated paper flags may be used on the pins, and when the epidemic is over the whole history may be read from the map.

Maps also facilitate inspection work, as it is easy to assign inspectors to definite districts and hold them responsible for work done. For this use, pins with inspectors' letter or number and the date fix the time of inspectors' visits.

Another most useful adjunct to this kind of work is a skeleton showing 4 blocks, with intervening streets and alleys, on a scale of 2 inches to the block. The inspector fills this in with the detail, drawing in freehand the location of infected houses, nuisances and the like, and adding on the wide margin any explanatory notes. Such sketch-maps enable the health officer at once to understand the situation reported and to file the report for record without trouble.

Medical Inspectors.—The duties of medical inspectors are: first, the examination of suspicious cases where no physician has been called, or if there is reason to believe that he has made a mistake or is wilfully concealing the disease; second, for vaccination or immunization of contacts; third, for the examination of contacts and convalescents prior to disinfection; fourth, for the inspection of school children. Regarding the first item, the health officer or his medical deputies should not intervene between patient and attending physician except on the strongest grounds or in great emergencies. The value and necessity of the next two heads are self evident, but that of the last is not so apparent.

In epidemics of diphtheria, measles and scarlet fever, it is better to have the children in a properly ventilated school house under daily inspection, than to have them running everywhere, uncontrolled. It may be necessary to stop picture shows, and Sunday schools or similar gatherings, but the opportunity to keep them under surveillance in the schools is one not lightly to be thrown away. This, however, does not apply to rural schools in thinly settled districts, where medical inspection is not possible and there is not much chance for the children to congregate.

Lay Inspectors.—Lay inspectors should have police powers, and may be detailed to look after quarantines, inspect for nuisances and see that they are abated, and after proper instruction, do disinfecting. Former soldiers, naval seamen, and marines make the best lay inspectors, as they are trained in hygiene and are accustomed to obey orders.

Special Hospitals.—The question of contagious disease hospitals is a difficult one in the small city or town for the reason that ordinarily no regular hospital of this kind is available and one must be improvised. If there is reason to expect an epidemic of any size of smallpox, cholera, yellow fever, typhus or plague, a special hospital should be at once instituted, as the expense and danger to the community are at once minimized. Some states give the health authorities power to seize property for this purpose, but in any case it is better to negotiate for the necessary site and buildings. The organization and maintenance of isolation camps and hospitals will be treated at length in a special chapter.

School Inspection.—As mentioned earlier in this chapter, school inspection is of the greatest value wherever it is possible to use it. In diphtheria, smears should be made from the mouth and nose

to locate carriers who might otherwise escape detection. Scarlet fever and measles are detected in their incipiency. At these times any children who for any reason are out of school should be visited by a medical inspector, and if not seen by any physician, he should examine them. No child should be permitted to re-enter school without a "clearance slip" from the health officer or a medical inspector, and the school authorities should daily receive from the health officer slips showing which children are excluded from school on account of disease and which are permitted to return. Forms for this purpose are shown and described in Chapter XXV. (School Inspection.)

Nurses.—The expense of nurses may be thrown on the municipality, and it is for the health officer to determine whether he will concentrate all his nurses in the isolation hospital or will divide his force in private houses. The former method is much more efficient—especially with a small force. Trained nurses may also be used to advantage as quarantine inspectors and instructors of volunteer nurses in private families.

Notification.—By statute and by the rules of the various boards, certain of the infectious diseases usually characterized in the statutes as "dangerous" are required to be reported within a certain period (usually 24 hours or less) to the local health office, in order that the proper action may be taken. This law is binding on householders and freeholders as well as on physicians, and the same penalties are prescribed for failure so to report. The form of this report and the records based thereon, as well as its final disposition, will be discussed in the chapter on *Statistical Methods.*

It is also made the duty of the health officer, on hearing from any source of a suspicious case, to investigate and satisfy himself as to its nature. It is good practice in order to make the reporting as easy as possible for physicians and the public, to accept telephonic reports and fill out the notification slips in the office, marking them "telephonic" to show the source of the information.

Plural Infections.

Inexperienced health officers are often skeptical as to the occurrence of two infectious diseases in the same individual at the same time. The following figures from the Kingston Avenue Hospital, New York, for 1908 are most instructive in this regard, and warn the health officer that if two or more epidemics are present in his

territory, he must be on the lookout for instances of plural infection:

Diphtheria and scarlet fever	44
Diphtheria and measles	19
Diphtheria and varicella	3
Diphtheria and pertussis	1
Scarlet fever and measles	41
Scarlet fever and varicella	8
Scarlet fever and pertussis	2
Scarlet fever, measles, and varicella	1
Measles and pertussis	6
Measles and varicella	5
Total	130

This gives an ineidenee of multiple or plural infeetions of 130 out of 2,887 cases treated—a pereentage of nearly 4.5—mueh higher than would be likely to be found except under metropolitan eonditions, where the above-named diseases are endemie.

Reduction of Mortality from Infectious Diseases.

The Report of the Department of Health for the City of New York for 1908, from whieh the above figures are quoted, present a most interesting summary of the reduetion made in the mortality from infectious diseases during the preeeding three decades. It should be noted that this Health Department is not only highly organized, but is well supplied with funds, the per capita appropriation being fifty eents, as against five to ten cents for the most of the eountry. When the remainder of the United States is as well organized as the City of New York, and as well provided with funds, the same results are to be expeeted elsewhere.

The following diseases and eauses of death are those which have been the targets against whieh the bolts of sanitary scienee have been hurled; and with what effect, the following comparisons, based upon the previous table, will show:

1. *Typhus Fever.*—This dreaded disease has entirely disappeared from the causes of death since the years of its importation, 1892 and 1893.

2. *Asiatic Cholera.*—In the year 1849 this disease carried off 5,071 inhabitants of the city; in 1854 there were 2,509 deaths reported, and in 1866—the year of the organization of the Board of Health—1,137 deaths; in the decennium, 1868-1877, 30 deaths; in that of 1878-1887, no deaths; in that of 1888-1897, 9 deaths; since 1892 the city has not suffered the loss of one inhabitant from this cause.

3. *Smallpox.*—Out of every 100,000 of the population 48 died in the decennium 1868-1877, 7 in that of 1878-1887, 3 in that of 1888-1897, and 2 in that of 1907, comparing the latter decennium with that of 1868-1877, a reduction of 95 per cent.

4. *Typhoid Fever.*—The rate per 100,000 in the decennium 1868-1877 was 31, and in the subsequent decennia fell to 28, 20 and 18; the rate fell to 12 in 1908, a decrease of 61 per cent. compared with that of the first decennium, a reduction which fell far short of the actual condition, for if we consider the immense strides made in medical diagnosis as to this disease, we can not but realize that in earlier decades many deaths that should have been reported under this heading found place under indefinite titles; for example, under the heading of typhoid fever, 4,445 deaths were enumerated in the first decennium, and 3,626 under that of malarial fevers, while under the same headings in the decennium 1898-1907 the figures were 6,349 and 1,112 respectively, the ratio of typhoid to malarial deaths in the first decennium being one and one-quarter deaths to one, and in the last six to one; undoubtedly there has been an immense transference from the malarial death column to that of typhoid; it is very evident that the deaths from malarial fever originating in this climate are seldom fatal, most of those that are reported being probably of a pernicious type having origin in southern latitudes. It is only fair to assume that the death rates from typhoid fever in remote years did not reflect the true index of mortality from this disease. If we add the number of deaths in the first decennium from malarial fevers to those from typhoid fever the result is a total of 8,071 deaths with a rate of 57 per 100,000 against 7,461 deaths and a rate of 21 per 100,000 during the last decennium, a decrease of 63 per cent.

5. *Malarial Fevers.*—In the decennium 1868-1877 the rate per 100,000 was 26, which rose to 30 in the succeeding one, then fell to 18, and finally to 3 in the last decennium; if we compare the latter rate with the first, a decrease of almost 90 per cent. will be shown.

6. *Measles.*—The mortality from this cause rose from 28 in the ten years 1868-1877 to 37 in the next decennium, fell to 31 in the next, and then to 20 in the last.

7. *Scarlet Fever.*—The decrease in the mortality from this cause has been a tremendous one, reaching 78 per cent., comparing the rates of the decennium 1898-1907 with that of 1868-1877; the number of deaths in the latter ten years reached 12,978, while in the former only 6,864 were reported.

8. *Diphtheria* and *Croup* gave a death rate of 153 per 100,000 in the decennium 1868-1877, and 53 in that of 1898-1907, a decrease of 66 per cent., that is where three children died from this cause in the former, only one died in the latter decennium; in 1894 the rate was 163 per 100,000; in 1895—the year of the introduction of diphtheria antitoxin—the rate was 127, and in the following year fell to 86, since which year it has not reached 60, and in 1907 and 1908 fell to 40.

9. *Whooping-Cough.*—Under this head 5,212 deaths and a rate of 37 per 100,000 were recorded in the decennium 1868-1877, and 4,124 deaths and a rate of 12 in that of 1898-1907, a decrease of 68 per cent.: that is, three children succumbed from this disease in the former to one in the latter decennium.

10. *Pulmonary Tuberculosis.*—There were 5,374 deaths reported under this heading in the decennium 1868-1877, with a mortality of 376 dying out of every 100,000 of the population; this high mortality rate fell gradually until in the decennium 1898-1907 it reached the comparatively low figure of 224, a decrease of 40 per cent. During the past ten years the number of deaths certified from this cause was 79,637.

11. *Diarrhœal Diseases.*—The mortality rate of 30.3 per 1,000 children under the age of five years in the decennium 1868-1877 fell to 23.4, then to 19.7, and finally to 13.5 during the subsequent decennia. The rate from this cause has always been considered a reliable standard whereby to judge the sanitary conditions of a locality, and from the above decline in the mortality—especially when the following facts are considered: first, the extremely high temperature occurring during the summer months; and second, the high birth rate among the foreign-born non-English-speaking population in the community—it is fair to assume that the efforts of this department supplemented by those of the various charitable organizations have been productive of this encouraging result.

12. *Death Rate of Children Under Five Years of Age.*—This is considered one of the most reliable tests of the sanitary condition of a community, and the following short table shows what proportion the decrease in mortality at this group of ages has taken place in the present Boroughs of Manhattan, Brooklyn and The Bronx, which house about 93 per cent. of the population of the entire city:

Decennium.	Average Number of Deaths Under 5 Years	Decennial Rate of Number of Children Under 5 Years.	Per Cent. Reduction of Previous Decennium.
1878-1887	21,653	97.8	..
1888-1897	26,142	86.2	12
1898-1907	23,305	57.9	33
1908	22,536	47.6	18

It is evident that this decrease in the mortality at this age-group has been a considerable one, greater, in fact, than at any other age-group, according to tables recently compiled, and we are not surprised at this when we consider the reduced mortality previously spoken of in discussing the rates from individual causes of death, such as measles, scarlet fever, diphtheria and croup, whooping-cough, diarrhœa, and to a limited extent, smallpox and tuberculosis.

Laws.—Having discussed the means to be employed in the management of epidemic diseases, the legal grounds on which action is based should next be considered. All health laws spring from the police power of the state, and in their last analysis are based

on the inalienable right of self-defense, which inheres in the state as in the individual. Since it is impossible for a legislature to foresee every contingency which may arise, the health statutes of all the states are flexible, delegating to the State Boards and to subordinate boards or officers the authority to act in emergency as they deem best for the public interest. For example, the Connecticut statute provides that boards of health have "all the powers necessary and proper for the preservation of the public health and the prevention of the spreading of malignant diseases" and makes it their duty to "examine into all nuisances, sources of filth injurious to the public health, and cause to be removed all filth found within the town which in their judgment shall endanger the health of the inhabitants." This act has been held to give express power to decide what is filth, and that no redress is possible for an error in judgment. *(Raymond vs. Fish, 51 Conn. 80.)*

A Massachusetts decision says "The board's determination of questions of discretion and judgment in the discharge of its duties is in the nature of a judicial decision and within the scope of the powers conferred, and for the purposes for which the determination is required to be made it is conclusive. It is not to be impeached nor set aside for error or mistake of judgment, nor to be reviewed in the light of new or additional facts. The officers or board to whom such determination is confided, and all those employed to carry it into effect or who may have occasion to act upon it, are protected by it and may safely rely on its validity for their defense." *(Salem vs. Eastern Ry. Co., 98 Mass. 431.)*

The tendency of the courts is to support the health authorities, at least regarding measures found necessary in epidemics, precisely as they protect the policeman who shoots a dangerous criminal who is resisting arrest, or the firemen who find it necessary to blow up a burning building to protect the remainder of the city.

By the statutes of all of the states, the health authorities are allowed to call on all peace officers for necessary assistance in compelling the observance of the health laws, and under various penalties this help must be provided, so that no health officer should confess himself helpless until he has exhausted this resource.

But, on the other hand, for failure to do his own full duty under such circumstances, he is liable to removal from office, to fine or imprisonment, or all three; and the State Board of Health by its agents or in person is authorized to take charge. So the state

protects itself against the derelict municipality as the city or town does against the individual.

The law, then, being what it is, gives every incentive to the honest, thorough performance of duty and throws the heavy weight of its displeasure against carelessness or willful neglect. There is no middle ground.

CHAPTER III.

ISOLATION AND QUARANTINE.

HISTORY.

Isolation of the sick, either by driving out from the house, camp or town or by the other method of deserting the sick, has been in use among all races since before the dawn of history. The word "Quarantine" itself is derived from the Italian *quarante* (forty) and signifies a period of 40 days' detention imposed on people and vessels coming from supposedly infected districts.

Quarantine may be declared against a nation, state, district, city, house or person or against a marine vessel. To declare a quarantine by no means makes it effective. Troops have been kept for weeks at a time on the boundaries of countries and states to prevent the introduction of some dreaded disease. With problems of this sort the local health officer will have nothing to do, except under the orders of his superiors, but the maintenance of a dozen or so of scattered houses in proper quarantine will tax his resources to the utmost.

DEGREES OF QUARANTINE.

There are several degrees of quarantine. The most severe is the permanent segregation in colonies enforced against leprosy and more recently against African sleeping sickness. The second kind is the "strict" quarantine against the more dangerous infectious diseases, and the third the "modified" restrictions placed on minor or less communicable conditions. To these may be added segregation of the inmates of institutions afflicted with sickness not dangerous in civil life, but important in the close confinement of such places. This will be fully treated under the head of "Institutional Sanitation."

There are also two measures not amounting to quarantine which should be noticed. These are: "Parole under Observation" allowed certain classes of contacts, and "Notification" for statistical purposes and for the sending of appropriate literature.

Special Hospitals.—The ideal condition in the management of infectious diseases is the free use of special hospitals, to which the patient is removed as soon as the diagnosis is made and where he is kept until all danger of communicating the disease is past. In crowded tenement districts it is the only way of preventing the spread of disease except by the employment of guards day and night, and guards are both fallible and corruptible. The establishment and maintenance of emergency hospitals of this kind will be discussed in a chapter devoted entirely to the subject.

Permanent Segregation.—The only disease in the United States to which this method is applied is leprosy. At least two states and possibly others have leprosaria. The Territory of Hawaii has the famous institution at Molokai and the Philippine Government has for the last eight years maintained a similar asylum on the Island of Culion. The local health officer discovering a supposed case of leprosy should take the matter up with his state Board of Health, who will relieve him of responsibility both by securing for him an expert diagnosis and arranging for the care of his patient.

Strict Quarantine.—In strict quarantine no one but the attending physician, the health officer and the undertaker (should his services become necessary) is allowed to enter the house. These persons must take certain precautions on entering and leaving, which will be mentioned later, since they apply equally to modified quarantine. Food and other supplies must be deposited at the quarantine limit, which should be indicated by ropes and flags or placards, there to be taken charge of by the inmates. Neither person nor thing must be allowed to pass out of the quarantine without disinfection by the health officer or the inspector in charge. Failure to observe these precautions makes the person committing the misdemeanor or permitting it liable to prosecution. Failure to enforce them on the part of the health officer makes him liable to removal from office, to fine, imprisonment, or all three, and probably makes the municipality subject to civil suit if infection can be proved to follow the neglect.

Isolation of the Sick.—Within the house the patient and nurse should if possible be entirely isolated from the rest of the family. These precautions will be observed, so far as expedient:

1. "Strip" the room by removing everything not absolutely necessary to the comfort of the patient and the health of the nurse.

2. If these articles are presumably infected, take them to another room and there disinfect them by the appropriate method.

3. Disinfect the remainder of the house if there is reason to believe it infected.[1]

4. Set aside a separate water closet for the nurse, if there is more than one. If she must share the one used by the family, let her use a chamber pail or vessel different from the one used by the patient, disinfecting the discharges in the same way as those of the patient before disposing of them in the closet or vault.

5. Nasal, throat, urinary and fecal discharges must be received in an appropriate vessel partly filled with a standard disinfectant solution, and after being properly mixed and subjected to the action of the solution for a sufficiently long time may be emptied into the vault or water-closet. If there are involuntary discharges they are best collected in newspapers or rags which are burned as soon as soiled. Japanese napkins or soft rags disposed of in the same way are permissible for nose and throat secretions, and for cleansing mouth and lips.

6. If the chamber vessel is to be handled by others, the outside of the vessel should be wiped with the standard solution before allowing it to leave the sick room and the hands of the person receiving it must also be disinfected as soon as the vessel is returned to the nurse.

7. Where the architecture of the house permits, the isolation of the sick room may be made complete by sealing up the door communicating with the interior of the house with heavy paper pasted on, and using only the outside door if there be one, or a window by which supplies are passed in and other articles passed out by means of a cord and basket, or better by a temporary stairway or by a ladder. If the inner door communicates with a hall having two stairways, one of which has an outside door opening directly into it, the hall may sometimes be divided advantageously by paper, cloth or temporary wooden screens, so as to admit of its use.

8. If there is a stove or grate in the room, it should be made use of to destroy all soiled cloths and papers and scraps of food; *or*, they may be put into paper bags and burned in a stove or furnace outside, or coal-oiled and burned in the open air.

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[1] In case the steps above recommended are not practical, leave the room as it is and use special care in disinfection after the recovery or death of the patient.

9. Dishes must be disinfected by placing in a standard solution for one-half hour before washing or removal from the room; *or*, placed in hot water and kept actually boiling for 20 minutes. If possible, dishes and table-ware should not be returned to the kitchen for washing, but the same ones washed and kept in the room, the dishwater being sterilized as in the next paragraph.

10. The patient must be bathed daily, and the hands and face often, at least twice daily. The bath water must then have 1/20th its bulk of carbolic acid or 1/40th its bulk of cresol added, well stirred into solution and allowed to stand for one hour before carrying out.

11. The floor must be swept daily, using sawdust moistened with a standard disinfectant solution to keep down the dust.

12. If an interior door must be used for communication, it should have a curtain made of a heavy sheet hung over it, which should be kept moist at first with 1:500 bichloride solution and afterwards with water. This door must be kept closed except when it is absolutely necessary for some one to pass.

13. Good ventilation into the open air must be maintained at all times for the sake of both patient and nurse.

14. Flies and mosquitoes must be absolutely excluded by screens and any in the room must be destroyed.

Isolation of the sick must be done wherever possible as the period of quarantine for contacts begins with the time of the last exposure. If, then, the contacts are allowed to enter the sick-room, under a strictly technical interpretation of the rule, and under some circumstances a necessary one, the period of quarantine for contacts would begin with the disinfection of the house and the discharge of the original patient from quarantine. It is also possible, especially in the country, to disinfect the clothing and persons of contacts and send them to another house to await under surveillance the outcome of the exposure. With the appearance of the prodromes of the disease, they may then be transferred to the original place to remain during their illness, leaving any remaining contacts for a further period of observation. The vehicle and driver employed in transferring infectious cases must be carefully disinfected before being employed for other work.

The diseases requiring rigid quarantine under the rules of the Public Health and Marine Hospital Service are:

Asiatic Cholera.
Bubonic Plague.
Yellow Fever.
Smallpox.
Typhus Fever.

To these New York adds:[1]

Diphtheria.
Measles.
Scarlet Fever.

And California to all the above:

$\left.\begin{array}{r}\text{Anthrax}\\\text{Glanders}\end{array}\right\}$ occurring in man.

Modified Quarantine.—In "Modified" quarantine, the wage earners of the family are allowed to enter and leave the house so long as isolation as indicated earlier in this chapter is properly carried out, and provided that their work is not such as to make this course dangerous. This privilege should not be accorded to a person engaged in the preparation, care or sale of food—especially milk, nor to a school teacher, and only so long as the following precautions, in addition to the ones noted, are faithfully observed.

In an uninfected room or outhouse he must have an uninfected or disinfected suit of outer clothing. He must remove the outer clothing worn around the house, bathe face, hands, arms and scalp with soap and water, and then with 1:2000 bichloride solution or 2 per cent carbolic solution or 1 per cent dilution of compound cresol solution (U. S. P.) or with an antiseptic soap of sufficient power. He puts on the clean outer suit and may then go to his work. A change of shoes is not necessary, provided they are thoroughly wiped with an antiseptic before he begins to change his clothing. In case, after investigation, the necessary care is not found to be used, the permit should be revoked and the quarantine made absolute. Such permit should always be written, in order that there may be no chance for misunderstanding, and written or printed slips conveying the above directions are also useful.

The list of diseases for which modified quarantine is allowable under the rules of most health boards follows:

[1] New York City places these under Modified Quarantine.

Diphtheria.	Rubella.
Measles.	Scarlet Fever.
Epidemic cerebrospinal meningitis.	Whooping cough.
Anterior poliomyelitis (infantile paralysis).	

Placarded Diseases.—In the practice of some boards the following diseases are allowed to be placarded without quarantine:

Measles.	Typhoid Fever.
Whooping cough.	Chicken-pox.

Exclusion from School.—Any of the diseases above named should exclude the other members of the family from school, either as teacher or pupils. No teacher or child having any of the following conditions should be permitted to be in school:

Hard cough.
Severe cold.
Influenza.
Itch.
Ringworm.
Tinea tonsurans (scald head).
Impetigo contagiosa.
Granulated eye lids.
Purulent, granular or trachomatous conjunctivitis.
Lice or other parasites.

Placards and Flags.—The requirements under the various statutes and rules differ so greatly that no directions can be given beyond saying that the law of his own state must be followed implicitly with regard to them, otherwise the health officer may find himself without a leg to stand on when he desires to prosecute violations of the law.

Personal Precautions.—There are certain precautions which the health officer, the physician and the undertaker must observe in dealing with diseases listed in the first and second classes of quarantine. Everyone whose duties call him into relation with these infections should be provided with sterilizable overall clothing of some kind. Some prefer a long hooded gown, covering completely all the body but the face. Others use a simple duck or denim suit of jumper and trousers, and a large white cap. If a beard is worn, it should be covered with gauze or a towel. In the presence

of pneumonic cases of plague, a mask should be worn, wet with an antiseptic.

Whichever costume is adopted is thoroughly soaked with bichloride solution 1:1000, and dried. It may then be sterilized by simply dampening thoroughly and rolling into a bundle, which is placed in a satchel or rubber cover, and will be ready for use again in a few minutes. Bichloride or other standard antiseptic solution should be used on the shoes or rubbers before leaving the place.

Person.—The hair and beard must be thoroughly moistened with 1:2000 bichloride or other antiseptic of equal power. The hands must be washed with soap and water and then with an antiseptic.

Instruments.—Thermometers and other instruments used in the sick room must be washed with carbolic acid 1:20, formalin 1:20, or cresol 2 per cent. It is best to have one thermometer for each house. Tongue depressors and applicators of wood are cheap, and are burned at once.

Clothing.—On reaching home all clothing should be changed and placed in a closet, box or wardrobe where it can be sterilized with formaldehyd gas, using the amounts of formalin and permanganate appropriate to the cubic contents of the receptacle. With a careful bath, at least of the exposed parts of the person, and fresh clothing, the disinfection is complete.

Contacts and Convalescents.—These methods must also be used with contacts, convalescents, and immunes released from quarantine. In the case of those recovered from scarlet fever and smallpox the antiseptic bath should be given twice on successive days before release, using soap and water with plenty of friction before the antiseptic, and paying particular attention to the scalp and hairy parts of the body.

Pets.—Dogs, cats, birds or other pets must not on any account be allowed to remain in a quarantined house. Their hair, fur or feathers make them excellent carriers of infection from house to house, and in the case of cats and dogs, mingling with others of their kind, makes possible infection which may over-spread a city when every human being has complied with the law. Before being excluded from the house such animals must be disinfected with carbolic acid 5 per cent or cresol solution 2 per cent, sufficient to saturate the skin thoroughly.

Vermin.—Since rats and mice are more than suspected of being

active agents in the spread of disease, a determined effort should be made to rid the premises of them by poison and traps.

So far as possible the house must be rid not only of flies and mosquitoes, but roaches and bedbugs. While only the first two are known to be disease carriers, other insects may also play a part, and it is wise to close every avenue which may permit the spread of infection.

CHAPTER IV.

ISOLATION HOSPITALS AND CAMPS.

Isolation hospitals and camps are worthy of more extensive use than is usually made of them in American practice outside of the larger cities. They are of the greatest service in the management of smallpox, Asiatic cholera, yellow fever, typhus and plague, and there are certain other diseases such as the mediæval sweating sickness, still surviving in isolated places in Europe, which would make them an imperative need. It is also usual, in Great Britain and some other European countries, to treat diphtheria, scarlet fever and measles in special hospitals. This is beyond all question the best practice, but except in very severe epidemics would not be approved by the public in this country, at least in the smaller places.

Site.—Having decided on the necessity for an emergency hospital, the first thing is to secure an eligible site, either by purchase, seizure or lease. This should be done under competent legal advice, in strict accordance with the statutes. Otherwise, wearisome and costly litigation may follow.

From the sanitary standpoint the following considerations must govern:

1. Convenience of access to good roads.
2. A distance from city limits of 1 to 2 miles.
3. A distance of 600 feet from inhabited houses.
4. A good and plentiful water supply.
5. Good natural or artificial drainage.
6. Sufficient area for all hospital purposes.
7. Shade and grass, so that out-of-doors may be pleasant.
8. Buildings adapted or adaptable to hospital use.
9. Electric current and telephone available.

Construction.—Having made a selection of a site, the buildings are to be inspected with a view to their best utilization. These may be old residences, warehouses or barns, or possibly some sub-

urban hotel or Chautauqua buildings left stranded by the collapse of a boom. These must be judged on their merits according to the following standards:

1. Ventilation; is it good?
2. Can the place—especially the wards—be well heated?
3. Can 1,200 cubic feet of air space and 120 square feet of floor space be allotted to each patient?
4. If conditions become unexpectedly worse can the arrangements be readily expanded to care for the increased needs?
5. Is there room for at least two wards, kitchens, store rooms, dining room, lavatory, laundry, nurses' quarters, physician's quarters, dispensary, morgue, sterilizing room, guard room?
6. Is sewerage available? If vaults must be used is there a good location? Is there room to improvise or install a garbage crematory?
7. Is there stable and shed room for ambulance and horses?
8. Is there room for a camp for contacts? Isolation quarters for convalescents?
9. If not already in, can electric current be installed? Telephone?

These things are not equally necessary, and every case must be decided on its merits. Sometimes the same room or building may be used for two diverse things. For instance, the laundry may be used as the sterilizing room or the doctor may sleep in the dispensary, but if the epidemic is at all an extensive one, all these things will be required and probably space will be needed for purposes which cannot be foreseen. Certainly a few private rooms in which the dying may lie are an advantage.

To take up the foregoing considerations in detail:

VENTILATION.—No infectious disease hospital should have a less floor space per patient than 120 square feet and a content per patient of 1,200, or better, 1,500 cubic feet. To secure ventilation in the first case, the atmosphere must be changed four times per hour and in the latter three times.

If gas or oil lamps are used, somewhat more space will be needed, as they help to vitiate the air and by their flickering make its rapid change unpleasant. A more rapid change than four times in the hour also creates a feeling of draft. To ascertain the rate of change, the room is filled with the smoke from burning rags or

paper with ventilators closed. The ventilators are then opened and the time for the air to become clear is noted. Since it is hardly probable that any modern system of ventilation is in place, a substitute must be improvised. If there is a sufficiency of windows, the problem is easy.

Screens.—The windows and all other openings in the house are first provided with small mesh screens, if the weather is at all warm or if the epidemic is likely to continue into warm weather. Thin pieces of board 6 inches high are fastened to the inside of the window casings from side to side, so forcing any draft which may come through the opened window toward the ceiling. Movable screens between window and patient may also be used as shelter from undesirable air currents. If electric current is to be had, small fans assist wonderfully. If there is a grate or fireplace in the room, a small fire should be kept constantly burning in it for its ventilating effect. If there is any bad odor in the room, the air is not changed sufficiently often and the defect must be corrected.

Heating.—There should be provision for heating at least part of the hospital even in warm weather, as there may be collapsed patients in the cool hours of the early morning who will need a high room temperature. Some means must be provided for holding the room temperature all the time at a point between 68° and 72°. The means will vary and every case must be settled as it best can.

Moisture.—It must not be forgotten that a very great factor in securing an equable temperature is an atmosphere properly moistened. A hygrometer for determining the water content of the air is almost as important as a thermometer. It should never be allowed to show less than 60 per cent of saturation at 70°. If too low, the water vapor may be added by boiling water on a stove or oil or spirit lamp, or by exposing dampened sheets in the room.[1]

Wards.—These should be not less than two in number for adults, and one or two more for children will be an advantage if there is a large number of patients to be cared for. There should also be private rooms for the very sick and for those having other infectious diseases as complications.

There must be the amount of floor space and cubic contents already mentioned as necessary for each bed, and this space must be so distributed that there is passageway around each bed, with

[1] This does not apply to summer conditions, except in very dry weather.

screens in place. The ward furniture will be discussed later in this chapter under the head of *Supplies.*

Kitchens.—Two kitchens are necessary in an infectious disease hospital—a diet kitchen for the sick and an entirely separate place where the food for the employees is prepared. To allow nurses and the sick to eat from the same utensils is to court infection, because some slip in the technique of disinfection may take place. If possible a trained nurse should be in charge of the diet, as in the infectious diseases proper diet is highly essential.

The diet kitchen should be furnished with a coal-oil or gasoline stove, or better, a hot plate, either electric or gas. A fireless cooker will greatly lighten the work, and will without trouble provide hot broths and soups at all hours. Vacuum bottles may also be used to keep food and drinks hot at the bedside.

The employees' kitchen should preferably be as far from the wards as possible or in another building, or if the weather is warm, a screened tent may be used, with another screened tent or shack as a dining room. Since the duties of attendants are sure to make the meal hours very irregular, a fireless cooker will be a good investment for this kitchen also. It is a great advantage in that it will provide hot meals for the night attendants without requiring a night cook.

Store Rooms.—Of these there should be two—one near the wards for a linen and spare furniture room and the other near the kitchen for food and cooking utensils.

Dining Room.—This should be carefully screened, as far as possible from the wards, and for the use of officers and employees only.

Lavatory.—This is a most important room, since it is there that the personal disinfection of the staff will be done. It should be well supplied with water, and best by running water; if it has not running hot water, there should be a means for keeping water hot all the time. There must be an ample supply of disinfectants of standard type, and no wash slops should either be thrown out or run into the sewer till they have been thoroughly disinfected.

Laundry.—The laundry is arranged like any other laundry, but nothing is allowed to go to it for cleansing until it has been immersed either in boiling water or a disinfectant solution for a sufficient length of time.

Nurses' Quarters.—These should be well ventilated and com-

fortable and are best provided in a separate building. At least one room must be capable of being darkened so that the night nurse or nurses may sleep well when off duty.

Physician's Quarters.—The doctor's quarters call for no special comment. Since he is in charge of the hospital, it is his own fault if he is not comfortable.

Dispensary and Office.—This room should be well lighted and provided with a table or two, a desk, some chairs and a set of shelves. The list of drugs required is not extensive and will readily suggest itself to any experienced physician.

Morgue.—Provision must be made for a morgue, since there will inevitably be deaths, and the dead must be handled with as little shock to the susceptibilities of the living as possible, while preserving the public interests unimpaired. Modern embalming fluids are excellent disinfectants, and if bodies are embalmed with them, wrapped in absorbent cotton or blankets soaked in 1:500 bichloride solution, and placed in cheap metallic coffins, hermetically sealed, the public health will be duly guarded and no one offended. Cremation is the best way of disposing of such cadavers, but crematories are rarely accessible from an improvised hospital of this kind, and public sentiment would certainly resent the use of the open funeral pyre except under stress of the direst necessity.

Guard Room.—A guard to prevent contacts, convalescents, and derelict employees from breaking quarantine is advisable, and often imperative. Either regular or special police, or deputy sheriffs may be employed, and National Guard troops have on rare occasions been used in this way. The guard must have suitable quarters outside the quarantine limits, and be subsisted wholly outside the hospital.

Sterilizing Room.—A sterilizing room where infected articles may be disinfected by any appropriate means is a convenience. Its use may be obviated by putting infected articles in the wards into covered pails which are then partly or completely filled with a disinfectant, the outside of the pail being mopped with the disinfectant, when the pail may be taken to the laundry, and after sufficient exposure, the articles may be washed.

Sewerage.—Sewer or cesspool connection makes a site much more desirable for hospital purposes. If not available, closets of the type described in Chapter XXXI are excellent substitutes.

Sinks and Vaults.—If these are used, they must be dug to a

depth of at least 8 feet, must be screened so as to be absolutely flyproof, and crude carbolic acid or cresol in milky emulsion of 5 to 10 per cent applied freely every few hours. Freshly made milk of lime may also be used but is hardly so effective.

INCINERATORS AND CREMATORIES.—These are of two kinds, one replacing the water closet or privy vault and the other the garbage crematory. They are portable, easily installed, not very expensive in first cost, economical in operation, inoffensive, and absolutely comply with sanitary requirements. There are several types of them made by different firms, all of which are capable of doing satisfactory work.

An improvised garbage crematory which will do good work is made by digging a trench $2\frac{1}{2}$ feet wide and 5 or 6 feet long, 6 inches deep at the upper end and 12 inches at the lower end. This is then filled with boulders and a fire built until the stones are thoroughly heated. Slops are poured in at the upper end and by their passage through the hot stones are evaporated; the solid parts after drying are raked into the fire to be burned. If long used, it has to be cleaned out and the ashes removed.

Semi-dry garbage may be well mixed with crude petroleum and straw, and burned either in the open or in a pit. The odors arising from this method are unpleasant but not unsanitary.

STABLES.—Stable room must be provided for the ambulance horses and ambulance.

Contacts and Convalescents.—If the weather is at all suitable, these are best cared for in tents or in shacks of light construction. Contacts should do their own cooking and cleaning, but convalescents will require a nurse and cook. If the wards are not too crowded, convalescents may remain there until just before discharge.

Supplies.—The supplies for an emergency infectious disease hospital of this kind are necessarily bought without bids wherever the needed articles can be procured in time, and fortunately are of a type to be obtained almost anywhere. They fall naturally into the following classes:

1. Ward supplies.
2. Kitchen and dining room supplies.
3. Medical supplies.
4. Transportation.
5. Food.

Ward Supplies.—These are of the simplest nature compatible with the comfort and well-being of the patients. Canvas cots are comfortable, cheap, easily cleaned and easily handled. They should have a doubled cotton comfort over them as a cushion and to prevent too sudden changes of temperature. The comfort may be reinforced by a few old newspapers next the canvas for warmth, or a bedsack filled with straw may be used. Spring cots with cotton mattresses are sometimes more easily procurable and will do nicely.

Pillows should be of cotton, woven wire or rubber cushions, but in the case of the first two, should have a cover of rubber sheeting under the slip.

The cotton comforts mentioned above and cotton blankets are to be had very cheaply in quantities, if there is time for negotiation.

Cheap unbleached or half-bleached cotton sheets should be procured in good quantity; or better, paper sheets and pillow cases which can be destroyed as soon as soiled. Paper towels and napkins are also cheap and convenient.

Old linen may be received from the outside to be used and then destroyed, but unless its source is definitely known, it is better to fumigate it with formaldehyd before using. It would not in the least simplify matters to have smallpox or scarlet fever introduced into a plague hospital in old clothing.

The cheapest nightgowns in assorted sizes should also be bought in as large quantities as may be thought necessary with a percentage over, to be sure of having enough.

Naturally, not all these things need be brought to the hospital on the opening day, but a sufficient reserve must be held in easy reach for unforeseen necessities.

Boxes will serve as bedside tables unless a sufficient supply of inexpensive small tables is in reach. Folding sewing tables are cheap and do not take up much room.

Plain kitchen chairs and a few rockers and canvas steamer chairs complete this part of the ward equipment.

Each bed should also have the following articles:

Enameled basin.
Enameled sputum cup.
China feeding cup.
Bent glass tube for drinking.
Pus basin or shallow pan.
Chamber vessel.
Rubber or waterproof blanket.
Hot water can or bottle.
Diet tray.
2 towels, small.
1 towel, large.

To each 2 beds:

1 slop pail.
1 water pail (covered).
1 bed pan.

To each 4 beds:

1 urinal.

The ward as a whole must be abundantly supplied with irrigators for saline enemata, and subcutaneous or intravenous injections, hypodermic syringes, catheters, dressing forceps, gauze, cotton and old cloths. There should also be some means of heating water quickly.

Dining Room and Kitchen.—The furniture for these rooms is of the simplest variety, boards laid on tressels or the cheapest of kitchen tables and ordinary wooden or camp stools or chairs being sufficient. Enamel ware is best for table use, as it can be boiled or treated with antiseptics without injury.

Food.—For the sick, milk (fresh, malted and condensed), with fruits, fruit juices, cereals, tea, coffee, cocoa, and bread and meats fresh daily, will give a sufficient dietary. If a skilled diet cook cannot be had, a few minutes' study of the catalogues of the large packing or preserving houses will show a large number of desirable articles in the way of soups and broths. The large biscuit factories also make many articles of invalid's diet, and almost any of the breakfast foods is desirable. Beef extract for its stimulant value should not be forgotten, and some of the predigested foods should be at hand for the very weak.

For the attendants, the food must be of the best quality, and prepared and served in the best manner. They are entitled to be well-nourished in order to resist infection.

Medical Supplies.—Any standard work on practice will suggest the articles likely to be needed, but the supply need not be elaborate.

Telephone.—A telephone is a necessity, but will be an unmitigated nuisance unless ringing-in is allowed only to those who give a secret number or pass, which can be changed daily if desired.

Electric Wiring.—If at all possible, electric wiring should be installed, as the power may be used not only for lighting, but for ventilating fans, for hot plates, for bed warmers, and to furnish

power for a vacuum cleaner, which by collecting the dirt in a place where it can readily be destroyed, minimizes chances for infection.

Transportation.—The proper transportation for persons sick of infectious diseases is a closed vehicle in which one or two persons may ride lying down. The ambulance of the U. S. Army type is the best form of conveyance, but a fairly good one may be made by taking a small spring wagon with a top, side and end curtains, and fitting it with two narrow litters.

If the demands are not heavy, a canvas cot may be used in place of the litters, but cots are too wide as a rule for more than one to be carried at a time.

The ambulance should be marked with a yellow quarantine flag and a green St. Andrew's cross. The Red Cross is forbidden by law and treaty to all but neutralized members of belligerent parties in war time, and to the Red Cross Society itself.

The personnel of the ambulance consists of the driver and a medical inspector who makes sure of the diagnosis before removing the patient to the hospital. They may wear a brassard on the arm or the green St. Andrew's cross on a white ground as a badge of authority, if desired, in place of the hitherto customary Red Cross.

The material carried should include beside the litters, an emergency case with hypodermic solutions already prepared, a bottle of aromatic ammonia, bichloride tablets, a pus basin and cloths for vomited matters, a water proof sheet, and restraint apparatus for delirious patients.

All of these materials, including the inside and outside of the ambulance, should be appropriately disinfected from time to time.

In case of resistance, the police or other peace officers should be called on to assist in the removal.

Accounts.—The accounts of a hospital are not necessarily complicated, but must be complete. They comprise:

1. Property purchased.
2. Property expended.
3. Inventory. (This checks the balance between 1 and 2.)
4. Time book and payroll of employees.
5. Inventory book of patients' property.
6. Descriptive book of patients.
7. Numerical account of patients.
8. Morgue list of places of interment.

The titles of these are self explanatory except Nos. 6 and 7. The descriptive book should be ruled horizontally so that one line is given to each patient, and vertically to allow the insertion of the following headings:

1. Name.
2. Sex.
3. Race.
4. Nationality.
5. Age.
6. Social condition (single, married, widowed, divorced).
7. When taken sick?
8. Where taken sick?
9. Admitted (month, day, hour).
10. Diagnosis.
11. Complications.
12. Final disposition (died, discharged, date).[1]

The numerical account of patients gives the number of patients received each day, and in the wards from the day before, and the number of patients discharged or who have died. The balance equals the number present for treatment on the following day. A similar account should be kept for the isolation camp for contacts. Patients are mentioned by name only on admission or at final disposition. During treatment they are carried as units in the total number. Thus account No. 7 must always balance with the totals admitted, treated, and finally disposed of as shown by account No. 6.

Recapitulation.—To be sure that all the steps involved in the admission and final disposition of a patient are correctly understood, let us consider the case of Mrs. A., sick in a railroad camp in the sanitary district of Beeville, which place has established a hospital to care for all cases of smallpox.

1. The rumor reaches the Health Officer.
2. He investigates; finds it true.
3. Notifies hospital.
4. Ambulance comes; medical inspector concurs in diagnosis (the concurrence of two physicians is usually required for removal to contagious disease hospital).
5. Prepares to remove patient; husband and friends resist.

[1] This may also be used as a card form.

6. Police summoned; patient forcibly removed.

7. Quarantine squad called; shack disinfected; inmates vaccinated; either quarantined in house or removed under guard to contact camp.

8. Mrs. A. arrives at hospital; inventory made of accompanying property or money; property then sealed in paper bag and disinfected; clothing of no value destroyed.

9. If condition permits, is given bath and haircut in bathroom; if not, is attended to in bed.

10. Ward sheet made up (history, orders, etc.).

11. Descriptive list made up from data furnished by medical inspector, or patient.

12. After 25 days has completely desquamated; is given disinfecting baths on two successive days and discharged, *or*

12a. Dies on fourth day; body taken to morgue; prepared according to rule; buried within 24 hours; record of place and time of burial entered in morgue book; if any property of value or money accompanied her to the hospital, it is returned to her family or turned over to the proper public official, taking receipts in writing.

Laws.—The laws under which authority is given for the establishment of hospitals for dangerous epidemic diseases are diverse and subject to not infrequent changes by new legislation. As advised in the earlier paragraphs of this chapter, the health officer will do best to take every step under competent legal advice, which can inform him exactly what to do under his peculiar local conditions.

As a necessary part of the quarantine power of the state "to place in confinement and to submit to regular medical treatment those who are suffering from some contagious or infectious disease on account of the danger to which the public would be exposed if they were permitted to go at large" it "is so free from doubt that it has rarely been questioned." *(State vs. Berg, 70 N. W. Rep.)*

In general these laws allow the employment of all necessary help, and state to what municipality the expense is chargeable. No part of the expense is collectible from the patients or their families, since they are involuntarily removed there for the protection of the public, and not for their own convenience, pleasure or

profit. Since this is done for the public benefit, the public must pay for it.

Since, too, the finding of the health officer is not subject to review by any court, it behooves him to be in every way sure of his diagnosis before removing a suspect to a place where, if not infected, he might contract a fatal illness. Absolute certainty is required before using the most arbitrary power confided to any civil officer or indeed to any officer in time of peace.

CHAPTER V.

DISINFECTION.

GENERAL CONSIDERATIONS.

Disinfection is the destruction of disease germs by any method. The great natural disinfectants are solar light and fresh air with its ozone. If every part of the thing to be disinfected could be exposed to their action for a sufficiently long time, nothing else would be required; but since sunlight is not always available, and cannot always be brought to the spot desired, and since fresh air cannot always be made to penetrate to the recesses of the article to be disinfected, we are forced to supplement them by artificial disinfectants, which are in the order of their efficiency:

1. Fire.
2. Superheated Steam.
3. Boiling.
4. Streaming Steam.
5. Dry Heat.
6. Chemical Disinfection.

Each of these agencies, properly handled, is effective; but used carelessly, none of them is of any value. Improperly done, they are positively harmful by giving a false sense of security. The method of using each, with the indications special to its employment, follows:

Fire.—This method is absolutely sure, and is the only means to be thought of for the disinfection of soiled rags and papers, tubercular sputum, soiled dressings from pus cases, and bedding of little value infected with any of the more resistant pathogenic microbes. To be of value, the infected articles must be burned *at once*, and not allowed to accumulate.

Superheated Steam.—This mode requires expensive apparatus which places it out of the reach of any but wealthy municipalities. The material to be disinfected is placed in large iron cylinders, from which the air is exhausted, after which steam under pressure

is turned in and the apparatus maintained for 10 minutes at a pressure of 10 lbs. to the square inch. If the preliminary vacuum is not used, the treatment is maintained for 20 minutes at a pressure of 15 lbs.

This is particularly valuable in ship and car disinfection, when large quantities of bedding and immigrants' clothing must be handled, as it not only disinfects, but kills all vermin. The main objection to the process is that it shrinks wool fabrics badly.

Boiling.—The articles are dropped into a vessel of water which is boiling strongly. It is applicable to white goods, metal articles, table ware, and bedding (except wool blankets and pillows). The addition of a teaspoonful of baking soda to each pint of water makes the action more certain. After coming to the boil again, the temperature should be maintained at that point for 30 minutes at low and moderate altitudes, but high in the mountains must be correspondingly increased. A fair rough test would be to place a moderate sized potato in the boiler with the goods, and when the potato is done, the disinfection is complete.

Streaming Steam.—For disinfection by streaming steam, an apparatus may be improvised consisting of a large wash-boiler with two bricks set on edge in the bottom, and short boards resting on them. A couple of inches of water is then placed in the bottom of the boiler, the infected articles are packed in loosely, the cover is put on, and the apparatus brought to the boiling point and maintained there for an hour.

This method is applicable to feathers, plumes, pillows and blankets, but presents no special advantages over *formaldehyd*.

Dry Heat.—The use of dry heat is hardly practical in sanitary disinfection, owing to the risk of overheating, burning and scorching.

Chemical Disinfectants.—These are of two classes, liquid and gaseous. To the first class belong bichloride of mercury, carbolic acid, the cresols, bleaching powder and sodium hypochlorite, and lime, since these are most readily applied in solution or suspension. The second class comprises formaldehyd, sulphur, and hydrocyanic acid, since to be effective they must be in gaseous form.

Bichloride of Mercury.—This is also known as corrosive sublimate and mercuric chloride. It is a disinfectant of great power and is applied in solutions of 1:500, 1:1000, and 1:2000, according to the purpose for which it is employed. It may be made with sea

water, and if made with fresh water must have twice as many parts of common salt or ammonium chloride (sal ammoniac) added to increase its solubility and to interfere with the precipitation of the bichloride by albumins which may be present. That is, a 1:500 solution requires 4 parts per 1000 of salt; a 1:1000, 2 parts, and so on. The efficiency of the disinfection is interfered with by alkalies, albumins, and most seriously of all, by sulphur and sulphides.

Bichloride solutions attack most metals and cannot be satisfactorily used on limed walls. They must be made up in a non-metallic container. The 1:500 strength is employed for feces and sputum, the 1:1000 for walls and floors and for clothing, and the 1:2000 for the disinfection of the person.

CARBOLIC ACID. (Phenol).—In 5 per cent solution this agent is well adapted to mopping floors, side walls and ceilings. It is cheap, does not affect metals or bright work, but attacks the hands so that it must be applied with a mop or spray, or the hands must be protected with rubber gloves. After exposure for an hour this solution may be used for stools and sputum.

CRESOLS.—The cresols are analogues of carbolic acid and belong to the same phenol group. They are sold under a variety of proprietary names, and are somewhat stronger than carbolic acid in disinfecting power. A 2 per cent solution is very satisfactorily used in the same way and for the same purposes as the carbolic acid solution just mentioned. In this strength it is not hard on the hands. An ordinary garden spray will be found very useful for applying this fluid to walls and ceilings.

FORMALIN.—This is a 40 per cent formaldehyd solution nominally, and actually contains from 2 per cent to 10 per cent less of the gas owing to volatilization, polymerization or faulty manufacture. It may be diluted with 19 parts of water for use on floors and walls, and stools or sputum will be innocuous after being exposed to its action in this strength for one hour. Ammonia interferes with its action, but albumin does not. It irritates eyes and nose strongly.

CHLORIDE OF LIME. (*Bleaching Powder*).—This must be of the best quality or it is worthless. If freshly taken from a full container it should be good. It should have a pungent odor of chlorine. $5\frac{1}{2}$ ounces of the powder are dissolved in a gallon of water, as pure and cold as possible. Chamber vessels and sputum cups are

partly filled with the solution before use, and the discharges are allowed to stand at least 30 minutes before emptying into the vault or water closet. Except that it is a somewhat better deodorant, it has no particular advantages over the solutions already named, any of which may be used for this purpose, all being equally worthless unless properly mixed with the infected material and allowed to stand for a sufficient time. Chloride of lime solution bleaches most colored materials and corrodes metals, so must be used with caution.

Lime.—This is one of the most valuable outdoor disinfectants. In powder it rapidly absorbs moisture and carbonic acid from the air, so that it must be freshly burned to be of value. As whitewash it furnishes a clean background against which dirt is readily perceptible, and entangles and destroys any microbes present. As a disinfectant it is used in the form of milk of lime which is made in the following manner; one quart of small pieces of quicklime is added to 1½ pints of water. This makes a dry hydrate of lime in powder. One pint of this powder is added to a gallon of water, and the resulting *milk of lime* may be used to disinfect stools and should be habitually employed in outhouses. If kept from contact with the air, this solution will keep a few days, and the hydrate will keep a week or two. This is the cheapest of disinfectants, an effective deodorant, and should be freely used on putrefying or putrescible matter of any kind.

Sulphate of Iron. (*Green Vitriol*).—This was formerly employed for the disinfection of outhouses and cess-pools, but recent investigations throw much doubt on its efficiency. It is not recommended.

FUMIGATION.

In order to disinfect successfully by fumigation certain precautions are to be observed. The room or building must be tight, and if not naturally so must be made so by pasting paper strips over all outlets from the area undergoing disinfection. Cracks under doors must be pasted over or chinked with rags. The atmosphere must be made both warm and damp. Good disinfection cannot be done with a temperature below 60° or an atmosphere less than 60 per cent saturated with moisture. This moisture may be natural on damp days, but in bright weather it must be augmented by boiling water on a stove, by pouring water (preferably hot) on to hot

bricks or stones, or by slaking lime. It is best to do this before beginning the disinfection proper in order that the moisture may have time to penetrate everywhere.

Since both formaldehyd and sulphur fumes are deficient in penetrating power, drawers and closets are opened up, beds unmade and everything spread as loosely as possible on chairs, lines and other supports. Books are spread with leaves and covers separated and set on end. If of little value they are best destroyed.

As a check on the efficiency of the disinfection, threads inoculated with easily identified resistant forms of bacteria, may be placed at various points and cultures made after the conclusion of the work will show whether the work has been thoroughly done or not. This check is particularly valuable if one cannot attend to the disinfection in person.

After disinfection by either of the above methods, if the weather permits, the entire contents of the room should be put outside to air and sun. If the weather is bad, the fumigated materials may be transferred to any convenient room while the second step of disinfection is undergone, which is the washing of floors and mopping or spraying of walls with one of the liquid disinfectants described previously—preferably bichloride, carbolic acid or cresol solution. These are non-volatile and remain in cracks and crevices for a long time, becoming more concentrated by evaporation of water.

Unit of Fumigation.—The unit employed in all fumigation is the amount of disinfectant required for 1,000 cubic feet, and is obtained by multiplying ceiling height by the length of the room and the result by the breadth, and pointing off three places from the right. The figures on the left of the decimal point will give the number of units. If the decimal is less than .750 and more than .250, a half unit additional should be added, otherwise the nearest whole unit is used. For example, a room 24 x 15 with an 11-foot ceiling has a cubical content of 3,960 feet, and 3.960 units of the disinfectant will be required, but under the rule 4 units should be used. A room of 3,190 cubic feet would employ only 3 units of the agent, while one of 3,350 would require 3½ units.

A method of computation which is not yet legalized, but entirely rational and also perfectly safe if silk test-threads are used, is to regard the disinfecting power of the gas used as proportional, not to the cubic contents of the room, but to the area of the walls,

floor and ceiling. On this theory a room of 10 feet cube, containing 1,000 cubic feet and having 600 square feet of exposed surface, requires one unit of the disinfectant gas, while a room 20 feet square and 10 feet high, containing 4,000 cubic feet, and presenting 1,600 square feet of surface, requires a little less than 3 units instead of 4 as would be required by the first rule. It is based on the theory that the disinfectant gases do not become neutralized or fixed in the free air, but only on the surface of objects. This same theory requires also that if a room contains a great deal of furniture, bedding and clothing beyond the average, that the charge of the disinfectant be proportionately increased. The advantage of this method of computation is the saving of expense for materials, which increases with the cubic contents of the space to be disinfected.

Expense.—Used in the quantities here recommended, the expense of fumigation with sulphur is about twenty-five cents per 1,000 cubic feet; with formalin and permanganate, thirty-five to fifty cents; with solidified formaldehyd in large units, from ten to fifteen cents. These figures are for material alone without considering cost of labor. The last method is not only cheaper, but more convenient and equally effective. If the apparatus allows the vaporization of water along with the paraform, it will also be more penetrating.

Sulphur Fumigation.—This is a very ancient method of fumigation, its use extending at least as far back as the Middle Ages. The fumes lack in penetration, so that the opening up of the materials to be disinfected must be very carefully done. Sulphur dioxide, which is formed by the combustion of sulphur in the air, blackens metals and bleaches colored fabrics badly. It is more trouble to use than formaldehyd, but is cheaper and has the additional advantage of killing vermin of all kinds. For these reasons it is preferable for disinfecting schools, vessels, freight cars, and public buildings, where the contents are of a character not likely to be injured by the fumes.

To secure efficient disinfection with sulphur it is necessary to have the atmosphere 4.5 per cent saturated, which is secured by burning 5 lbs. of sulphur and the evaporation of 1 pint of water for each 1,000 cubic feet of space to be disinfected. The room must be made absolutely tight as sulphur works rather slowly, and any leakage will reduce the percentage of gas below the allowable limit.

The sulphur should be finely powdered, as roll sulphur is less combustible, goes out badly and leaves much residue. It should be burned in shallow iron pots or Dutch ovens, which are placed in tubs of water and covered with wire screens to catch any of the burning sulphur which may pop out. Not more than 30 lbs. should be placed in any one burner and better only 5 to 10 lbs. The sulphur is best fired by pouring on a little wood alcohol and lighting with a match. Twenty-four hours are required to kill the more resistant bacteria, but mosquitoes and other vermin are killed in from two to four hours.

Formaldehyd Fumigation.—Formaldehyd has come of late years to be the disinfectant of choice for use by fumigation. Many methods are in use, some of which require complicated apparatus. Of these but three will be described. The health officer desiring to investigate any of the others will find them fully described in the publications of the Public Health Service. Formaldehyd by any method does not tarnish metals, fade or turn colors. *It does not kill vermin or mosquitoes, and must never be employed for such a purpose,* but the addition of ½ ounce per 1,000 cubic feet of camphor to a solid formaldehyd disinfection, will kill insects.

Spraying.—By this method, the formaldehyd in 40 per cent solution is sprayed with the finest nozzle of a garden spray-pump on sheets hung about the room. This must be done as evenly as possible, so that the drops do not run or coalesce. An ordinary large sheet will hold about 5 oz. or a little more, and two sheets and 10 oz. of the solution will be required per 1,000 cubic feet. This process cannot be relied on below a temperature of 72° on account of the formation of the polymeric body paraform. The sealing of the room must be done with great care, the exposure continued for 12 hours, and not over 2,000 cubic feet disinfected in one body.

Permanganate Method.—In this process the formaldehyd is poured over potassium permanganate crystals, in the proportion of 1 qt. of the former to 1 lb. of the latter. *CAUTION! If the permanganate is thrown into the formalin, it may explode.* In most of the states this amount is required for 1,000 cubic feet, but the Public Health Service allows this amount for 2,000 cubic feet and if the temperature is above 60° permits the use of only 10 oz. of formalin and 5 oz. of permanganate.

When the reagents above mentioned are mixed, a violent effervescence takes place and almost the whole of the contained formal-

dehyd is set free within a very few minutes. This gas is very dry and highly inflammable, and naked flames or fire of any kind must be kept away for fear of explosions. The residue left at the close of the reaction is a nearly dry mass when the reagents are of good quality. At least 4 hours' exposure are required for effective disinfection by this means.

Paraform.—"Solid Formaldehyd." The use of paraform—the solid polymer of formaldehyd—by heating over specially constructed lamps has met with favor. Used with moisture in the proportion of 1 oz. per 1,000 cubic feet it is very convenient and

Fig. 1.—Types of generators for disinfection with solid formaldehyd (Paraform).

effective. The candles with wicks running down through the paraform are not to be recommended since too large a proportion of the gas is burned in the process of volatilization. Still less are the compound candles of paraform and sulphur to be approved, as the products of sulphur combustion unite with the formaldehyd and consequently neither portion is of value.

Hydrocyanic Acid.—"Prussic acid." This is not properly speaking a disinfectant, but is the most certain and deadly of poisons to all animal life. It destroys infallibly all kinds of vermin, *but is on no account to be used without every precaution, since it is almost instantaneously fatal to human life.* Hence, no

one can remain in a house where it is being used, and sufficient ventilation must be left to allow the air to be completely changed in say 6 hours. These ventilators must be protected from incautious approach, since fatal poisoning might occur from going too near them.

It is only justified for use in case of typhus or plague where lice or rats are presumed to be concealed in places where sulphur cannot readily reach. In the hands of experts it may be used to destroy mosquitoes in living quarters, or rats and weevils in mills and elevators, but is hardly justifiable for such purposes in the hands of the inexperienced.

For each 1,000 cubic feet the following are required:

Potassium cyanide	10 oz.
Sulphuric acid	15 oz.
Water	23 oz.

The sulphuric acid is added slowly to the water in some vessel which can stand the heat. The potassium cyanide is placed in a bag which is tied, and lowered into the acid by a string passing outside the room. If several rooms are to be treated, this arrangement may be used for all, and the strings cut in turn, beginning at the one farthest from the exit, and placing the cyanide for the halls in *two* sacks, one inside the other, which may be dropped into the acid in passing out. This will delay action for a couple of minutes and give enough time for escape.

Responsibility.—The responsibility for proper disinfection rests on the health officer, and if he cannot do it himself, he should see that only reliable persons do it for him. The work should be checked by the use of infected threads as mentioned earlier in this chapter. Care should be taken, not only that disease germs are destroyed, but that property is not damaged by fire or chemical fumes, as suits either against the health officer or the municipality may follow, and even if they do not, a prejudice is created which is entirely unnecessary.

Expense.—The expense of disinfection is variously taxed. In some states it is placed against the householder, and in his default against the property disinfected. In other states it is more properly paid by the municipality. This is the better and wiser plan, as there is not the temptation to hide disease to escape expense as

well as the inconvenience of quarantine. It is no more reasonable to expect a man to pay for the disinfection of his house after an infectious disease than it is to ask him to pay for the apprehension of the burglar who has robbed him or the murderer who has killed a member of his family.

CHAPTER VI.

THE TYPHOID GROUP.

The characteristics of this group are disturbances of the gastro-intestinal tract, as diarrhea and vomiting. Infection is taken in practically always by the mouth. It may be by contact, mediate or immediate, in which excreta bearing the specific micro-organisms are conveyed to the patient's mouth by unwashed hands, in food or drink infected by carelessness in handling these excreta, by carriers, or by flies and dust.

In the investigation of outbreaks of these diseases in the country or small towns, the water supply is first to be suspected; then improper disposal of excreta; the food supply, including milk; flies and dust. Human carriers play a considerable part, which is probably more important in the city than in the country, in proportion to the total number of cases. In cities having a proper sewage disposal, flies and dust can almost be eliminated, while in temporary communities such as railroad camps they play a large part, and in small permanent communities should always be taken into account.

It should not be forgotten that in considerable epidemics all of these causes may be and usually are operative, especially in typhoid, paratyphoid and Asiatic cholera.

The feces and urine are the channels for the perpetuation of the infection, and must always be carefully disinfected before putting them into the closet or sewer.

TYPHOID FEVER.

Synonyms.—Enteric fever; abdominal typhus; autumnal fever; "Typho-malarial fever."

Distribution.—Endemic everywhere, becoming epidemic at times.

Etiology.—Infection by and growth of *Bacillus typhosus* (Eberth). This micro-organism is 1 mi. in width and 3 mi. in length, varying somewhat with cultural conditions; stains with watery methyl blue, but not by Gram's method; resists moist heat

up to 156°F (69°C); lives three months in distilled water and 6 months in moist earth; withstands repeated freezing and thawing; is killed by 6 hours of direct sunlight, 0.5 per cent phenol and 1:5000 bichloride solution. It must be taken into the alimentary canal to produce infection, and in the so-called "Typhoid carriers" may remain there for years, being transferred by their dirty hands to the food and drink of others, thus causing new cases. Milk and water are frequent sources of infection, and green vegetables which have been contaminated by sewage are other important sources. The common house fly is extremely dangerous in the direct carrying of typhoid discharges to food and drink, especially in localities without sanitary sewers. Dust may be a conveyor, either by inhalation or ingestion.

Pathology.—Anatomically characterized by hyperplasia and ulceration of the lymph follicles of the small intestine and mesentery, and enlargement of the spleen, these organs containing great numbers of the bacilli. Bacilli are somewhat rare in the blood stream, but have been found as single foci in almost every organ of the body. The urine and feces are loaded with bacilli.

Predisposing Factors.—Age below 30; male sex; epidemics most common in late summer or autumn.

Incubation.—One to two or more weeks.

Prodromes.—Malaise; loss of appetite; slightly coated tongue.

Symptoms.—In children, attack may begin with headache, nausea, chilliness and furred tongue. At all ages there may be nosebleed; looseness of bowels; "Stairstep" temperature curve; pulse usually moderate; rose spots on abdomen and sometimes on other parts of body, disappearing on pressure; "Pea soup" stools of clay color. These symptoms are common but not invariable. More rare are petechiæ, sudamina and vibiæ; hemorrhage of the bowels is frequent, as is gurgling in the right iliac region. Delirium, tremor and hiccoughs are often seen late in the disease. Hemoglobin is always diminished, and the leucocytes, normal in number at first, are diminished slightly and gradually through the course of the disease, not becoming normal until some time after convalescence is established. Relapses are common in this disease and may be multiple.

Diagnosis.—Clinically this disease may usually be diagnosed by the signs and symptoms above enumerated; the diazo reaction of the urine is of some value, but the serum (agglutinin) reaction of

Widal and Gruber is with proper technique and exclusion of a recently preceding attack of typhoid, or recent immunization by typhoid bacterin, almost absolutely diagnostic if positive, and should be found in 70 per cent during the first week, 80 per cent during the second and 90 per cent during the following two weeks. (See Part III for diazo and agglutinin reactions.)

Differentiation.—Differentiate from paratyphoid; estivo-autumnal fever; acute miliary tuberculosis; cerebrospinal meningitis; pneumonia; concealed suppuration.

Sequelæ.—Cholecystitis; gall-stones; "Milk leg"; "Typhoid spine"; neuritis; nephritis, rarely; bone lesions, commonly.

Termination.—After 4 weeks in uncomplicated cases, the temperature usually declining regularly and gradually. In fatal cases the cause of death may be exhaustion, toxemia, syncope, hemorrhage, or perforation of the bowel and consequent peritonitis.

Immunity.—Second attacks occasionally occur.

Prognosis.—The mortality in private practice with family nursing is 20 per cent and with skilled nursing is 10 per cent (Tyson). With full cold bath treatment Osler and Tyson each report 7.3 per cent. The mortality from 18 to 22 and after 40 seems to be higher than at other ages, and pregnancy adds a great additional risk, as abortion usually takes place in the second week of the disease.

Quarantine.—In civil practice, none; in camp practice, such as railroad construction and other public works, if possible, the patient should be removed to a special hospital at a distance from the work.

Individual Prophylaxis.—Boil water; screen all food from flies and protect from dust. If nursing a patient, disinfect hands with soap and water followed by an antiseptic wash. Pay attention to the condition of stomach and bowels. Protective inoculation by Sir A. E. Wright's method is of the greatest value for professional nurses and travelers who are likely to be exposed to typhoid.

This vaccine is prepared commercially by several of the large manufacturers of biological products and is also to be had free from some of the state laboratories. It is prepared by suspending killed typhoid bacilli in physiological salt solution, and is usually standardized at 1,000,000,000 per c.c. The first dose is one-half that amount; the second, on the eighth day, is the full dose of 1 c.c.; and the third, on the fifteenth day, is the same as the second.

To administer this vaccine the hypodermic syringe and needle

are carefully boiled, the ampoule containing the vaccine is opened, the needle placed in it, and the syringe filled and emptied several times in order that the suspension may be as uniform as possible. In the meantime the arm, *without previous washing,* has been painted with tincture of iodine to a deep brown color over an area of 2 inches in diameter. The needle is introduced only into the subcutaneous tissues; not into the fascia or muscle. The puncture is sealed with collodion.

There is generally some reaction following the first dose, but this is seldom severe and rarely consists of more than slight chilly sensations followed by a rise of temperature of a degree or two. There may also be a slight local reaction, with swelling of the axillary glands for a day or two.

This has been largely used in military practice and reduces the incidence from typhoid fever to almost nothing. The immunity lasts for several years at least, but the point of loss of immunity is not known. Persons who have had this treatment give the Widal reaction, and in case of doubtful diagnosis of any fever in a person so immunized, a blood culture is necessary.

Community Prophylaxis.—All bodily discharges from the patient must be disinfected with a standard disinfectant. Make a thorough search for any water or milk supply that may possibly be contaminated. If any other source of water supply is available, condemn the one at fault; if not, boil water for 20 minutes and preferably, filter and aerate. Eliminate all sources of contamination to water. If a public supply such as a reservoir is infected, install filter beds; if these are already in use, they must be remodeled or renovated under the supervision of a competent sanitary engineer. In addition the filtered water should be treated by some such method as the hypochlorite if possible. If a well is at fault it can be made safe by disinfection. A cistern may always be disinfected. If it is desired to destroy a well it may be done by throwing in kerosene and thus making the water permanently unpotable, but leaving it as good as before for washing clothing.

Seek out carriers and have them taken from handling food supplies. Carriers are more readily found by the agglutinin (Widal) reaction than by plating the stools, and this should never be omitted in looking for carriers. If the reaction is positive the stools are plated, and the matter may be definitely settled.

Stools and urine of typhoid patients must be disinfected with a

standard disinfectant (see *Disinfectants*), exposing the exercta to the action of the disinfectant for at least one hour before throwing into the closet or vault. Soiled linen or clothing must be kept protected from flies, and boiled, or sprinkled with 40 per cent formaldehyd solution and left rolled up in a tight container for at least 6 hours before sending to the laundry. Screens, fly paper and fly poison together with destruction of all possible breeding places, must be used to keep flies out of the sick room and away from infected material.

Disinfection.—Disinfect by scrubbing the walls and woodwork of the sick room with soap and water and afterwards with a standard disinfectant. Fumigation is required by some states.

PARATYPHOID FEVER.

Etiology.—This disease is caused by a bacillus or group of bacilli, intermediate in character between the typhoid and colon groups.

Distribution.—Sporadic everywhere; occasionally becoming epidemic.

Pathology.—Spleen enlarged; intestine sometimes ulcerated, but the ulcers resemble those of dysentery rather than those of typhoid; Peyer's patches are *not* ulcerated. Focal necroses have been found in the liver. The lesions are in general those of septicemia and not those of typhoid.

Symptoms.—Typhoid in character, milder in course, and of better prognosis. Diarrhea and termination by crisis are more common than in typhoid. Muscular inflammation and joint abscesses are complications very rare in typhoid and observed with some frequency in paratyphoid.

Diagnosis.—Negative agglutination with the *Bacillus typhosus,* and a positive reaction with the paratyphoid bacilli.

Prognosis.—Better than that of typhoid, but no exact statistics either of mortality or morbidity are available.

Prophylaxis.—In all particulars the same as typhoid.

MOUNTAIN FEVER.

A true typhoid, as shown by the serum reactions, and from the standpoint of the sanitarian to be treated in all respects as such. It must not be confounded with tick fever.

AMEBIC DYSENTERY.

Synonyms.—"Flux"; "Bloody Flux."

Definition.—An acute or chronic inflammation of the large intestine, caused by infection with the *Entameba histolytica.*

Distribution.—In all tropical countries, and over the entire United States.

Etiology.—The organism is taken in with contaminated water or food, the most frequently infected food being salad vegetables eaten raw. *Entameba histolytica* is from 15 to 20 mi. in diameter and consists of a clear outer zone (ectosarc), and a granular inner zone (endosarc), and contains a nucleus and one or two vacuoles. The movements of this organism resemble those of the ordinary Ameba, and consist of slight projections or retractions of the protoplasm. They frequently contain red blood cells which they have taken in. They are easily to be recognized in the tissue by proper stains, and may be in enormous numbers. They can be recovered from the pus of liver abscess following dysentery. *Entameba histolytica* has been cultivated by a number of men, but with some difficulty, and it seems that certain bacteria are necessary to successful growth. It has an encysted or resting stage in which it resists drying for months.

Pathology.—The lesions are found in the large intestine, and more rarely in the lower part of the ileum. Abscess of the liver is very common, occurring in about 20 per cent of the cases seen in the Johns Hopkins Hospital.

Intestines.—The lesions are ulcers, preceded by an infiltration of the submucosa consisting of swelling of the tissue and multiplication of its fixed cells. The mucous membrane over these areas soon become necrotic and sloughs, leaving the submucous tissue as a grayish-yellow gelatinous mass, which is the first floor of the ulcer but later is cast off. The ulcers are oval, round or irregular, with infiltrated and undermined edges. The ulcer itself may be very large compared with the small opening through the mucosa. Any of the coats of the bowel except the mucosa may form the floor of the ulcer according to the state at which it is observed.

Amebæ may easily be found infiltrating the tissues.

Liver.—Lesions in the liver are of two kinds; a disseminated focal necrosis of the liver tissue, and a true abscess formation. Either type may follow cases of dysentery of any grade of severity.

Abscesses may rupture into the bowel, the peritoneal cavity or the pleura, or may become encysted. Secondary infection with pus organisms may take place.

Symptoms.—MILD FORM.—Infection may be present for a month or longer before symptoms are shown, except the most vague as headache, lassitude, slight pain in the abdomen and occasional diarrhea.

ACUTE FORM.—Pain and tenesmus severe; blood and mucus are found in stools and later sloughs may be passed. In very severe cases the stools are passed every few minutes. The temperature is ordinarily not high, but emaciation may be very rapid, and death may occur in a week.

CHRONIC AMEBIC DYSENTERY.—The disease may begin either in an acute or sub-acute form, gradually passing into a chronic form, the special characteristic of which is the alternation of constipation and diarrhea. During the exacerbations, the symptoms are much the same as in the acute form, with pain in the bowels and blood and mucus in the stools, with slight fever. These attacks recur at intervals of weeks or months. The patient often does not feel very ill and the quiescent periods allow some degree of restoration of strength so that emaciation is not so extreme as in the acute form.

Diagnosis.—By the presence of motile amebæ containing red blood cells in the stools. The specimen should be examined on a warm slide.

Prognosis.—Of Osler's cases 23.5 per cent died. The tendency to relapse is very marked. Of his liver abscess cases 19 out of 27 died, and of the operative liver abscess cases 12 out of 17 died.

Individual Prophylaxis.—All water should be boiled before drinking and kept well covered until used. Green vegetables should be scalded or covered with strong vinegar an hour before use. The hands should be carefully cleansed after contact with the patient.

Community Prophylaxis.—All bodily discharges from the patient must be disinfected or destroyed in the same manner as for typhoid fever. This disease is not at present notifiable, but should be made so as it is a really dangerous infectious disease. Owing to its wide distribution and the ease with which one carelessly handled case may light up a serious epidemic, every precaution should be observed.

BACILLARY DYSENTERY.

Synonyms.—"Flux"; "Bloody Flux."

Definition.—A form of intestinal flux, usually of an acute type, occurring sporadically and in severe epidemics, attacking children as well as adults, characterized by pain, frequent passage of blood and mucus, and due to the action of a specific bacillus of which there are several strains (Osler).

Distribution.—World wide, with high mortality everywhere, but especially in the tropics and Japan.

Etiology.—This disease, owing to improved sanitation, is more rare than formerly. It is sporadic during warm seasons everywhere and tends to become epidemic especially in crowded institutions. It has been particularly fatal in military camps.

Bacillus Dysenteriæ.—This is the specific morbific agent. As a cause of dysentery it is approximately twice as frequent as the amebæ. The original form was discovered in Japan by Shiga in 1898. Since then at least two other types known as the Flexner-Harris type and the "Y" or Hiss-Russell type, varying principally in their sugar-splitting action, have been isolated. The common type in the United States is the Flexner-Harris. A serum capable of agglutinating one strain agglutinates the other two to a less degree. Some of the summer diarrheas of infants are due to this bacillus.

Incubation.—Not over 48 hours.

Symptoms.—The onset is sudden and distinguished by pain in the bowels, slight fever, and frequent stools. There is constant desire to go to stool, with great straining and tenesmus. Every half hour or so there may be a passage of a small amount of blood and mucus. The temperature rises and may reach 104°; the pulse is small and frequent, the tongue furred, and there is great thirst. In very severe cases the condition becomes critical in 48 hours and death may ensue on the third or fourth day. In moderate cases the symptoms gradually abate and convalescence is established after two or three weeks. The *Bacillus dysenteriæ* is found in the stools and agglutinates with the blood serum.

Pathology.—When death occurs on the fourth to the seventh day the mucosa of the large intestine is swollen, deep red in color, and presents many corrugations and folds. There are also hemorrhagic spots. There is no ulceration, but a general superficial

necrosis of the mucosa. These conditions extend to the ileum more frequently than the corresponding lesions of amebic dysentery.

Prophylaxis.—Since the germ has never been found outside the body, and since the mode of infection is not known, it should be assumed that it is communicated by carelessness in the handling of the discharges, and the hands of attendants and the discharges themselves should be disinfected with the same scrupulous care as in Asiatic cholera. Water should be boiled, the milk supply carefully looked after, refrigerators carefully cleansed, and the food in general carefully gone over. Flies should especially be guarded against. In all institutions—especially those having the care of children—the patient should be isolated, and in civil practice the disease should be made notifiable in order that proper methods of disposing of the stools may be enforced.

ASIATIC CHOLERA.

Definition.—A specific infectious disease, characterized by vomiting, purging and collapse. The infective agent is the *Spirobacillus comma* of Koch.

Distribution.—Endemic in India—particularly in the delta of the Ganges, in southern China, and possibly in the Philippines. At intervals of several years it becomes epidemic in various localities—particularly in the Orient, and has on several occasions in the Nineteenth Century become pandemic, covering almost the entire civilized world.

Etiology.—The symptoms of the disease are due to the toxins of the bacillus and are intimately connected with its proteid content. They are so unstable that it is yet impossible to separate them. In acutely fatal cases the organism does not invade the intestinal wall, but in more chronic cases this occurs.

Immunity.—There is no certain natural immunity, since second attacks within a short time of the original but too late to be considered relapses are by no means rare. Artificial immunity of some value has been conferred by the Haffkine serum, but a bacillary vaccine prepared after the method of Wright has proved very much more successful.

Incubation.—From 1 or 2 hours to 6 days.

Modes of Infection.—Always by the mouth in infected food or water. Fly-borne infections, as well as infections by the hands of "carriers" are well-known. Sudden widespread local epidemics

occurring without visible connection between the cases are due to infected water supplies. Air-borne infection, except possibly in dust, is not known and must be rare since the bacillus is sensitive to drying and sunlight, without which factors dust cannot form.

Pathology.—The diagnosis can always be made by the presence of the specific organism. The body shows the appearance of profound collapse. There may be post-mortem elevation of temperature. Rigor mortis sets in early and is often so marked as to cause movements of the limbs. The blood is thick and dark, owing to the amount of its fluid constituents taken out by the vomiting and purging. The peritoneum is sticky and congested and the intestines shrunken. The small intestine may contain a turbid fluid rich in cholera bacilli. There is cloudy swelling of the liver and kidneys.

Symptoms.—PRELIMINARY DIARRHEA.—There is commonly a slight looseness of the bowels with colicky pains, perhaps vomiting, headache and depression of spirits. This is by no means invariable, as many of the cases seen in the Philippine epidemic of 1902 by the writer showed no preliminary symptoms whatever. Fever if present is slight.

COLLAPSE.—The diarrhea increases, or if of the type just mentioned sets in abruptly with the greatest intensity. There are griping pains, tenesmus, cramps in the lower extremities. The thirst is tormenting, vomiting severe, the tongue covered with white dried mucus. The features are shrunken, the eyeballs sunken, nose pinched, cheeks hollow, and the body literally shrivelled. The skin is clammy and withered and the skin temperature low—even as much as ten degrees subnormal, though the internal temperature may show as high as 104°. The stools are at first yellowish with bile pigment, but soon assume the distinctive "rice water" appearance, the floating clumps of bacilli looking like bits of boiled rice or sago starch. The pulse becomes very rapid and feeble, and coma may come on, or consciousness may be retained till the very end.

REACTION STAGE.—When the patient survives the stage of collapse, reaction gradually takes place, and sometimes with almost as great rapidity as the collapse which preceded it. All the symptoms ameliorate and the first crisis is passed, but the patient has yet the dangers of urinary suppression and a chronic form of cholera known as *cholera typhoid,* comparable in many ways to

that disease. These two conditions are fatal in many cases which are safely past the stage of collapse.

Cholera Sicca or dry cholera is the name given to an atypical form in which the infection is so intense that death takes place before purging begins, sometimes in an hour or less from the first cramp.

Differentiation.—Differentiate from *Cholera nostras*, a precisely similar affection arising in summer in temperate climates from a cause as yet unknown. *Cholera nostras* is sometimes fatal in as short a time as 12 hours, especially in feeble people.

As before stated, the diagnosis of Asiatic cholera is most certainly to be made by the bacteriologist, though one who has had large clinical experience with the disease can almost diagnose it in the dark.

Prophylaxis.—The same in all respects as for typhoid fever with a six days' quarantine added for contacts and suspects. The patient should not be liberated from the isolation hospital until careful tests show the stools to be free of bacilli.

Disinfection.—Fumigation by sulphur or formaldehyd (the latter preferred), whitewashing or painting, and using soap and water and liquid disinfectants afterward.

CHAPTER VII.

THE EXANTHEMATA.

The exanthemata have in common certain skin symptoms or *exanthems*. They may be air-borne or communicated by fomites such as infected clothing or rooms. Insects are facultative carriers, but so far as known none of this group has as a necessary part of its etiology an extra human cycle, like that of malaria. It is very possible, however, that members of this group will in the light of fuller knowledge be transferred to other families, as has already been the case with yellow fever, which, a dozen years ago was supposed to be communicable in the same manner as the diseases here classed as exanthematous.

Such discoveries will simplify greatly the management of these diseases, since the easiest place to break the chain of infection is between the human and the extra-human host. These disorders present great differences in the tenacity with which the infection clings to convalescents and infected articles, which variations will be noted under the proper heads.

SMALLPOX.

Synonym.—Variola.

Definition.—An acute infectious disease, characterized by a cutaneous eruption which passes through the stages of papule, vesicle, pustule and crust (Osler).

History.—This disease has been known for centuries, particularly in China. Galen described a *pesta magna* which is now identified as smallpox. It became widespread in Europe during the Sixth Century, was spread by the Crusades, introduced into the Western Continent during the Sixteenth Century, and until the discovery of vaccination in 1796 by Jenner was easily the first of the "Captains of the Men of Death." Since that time in communities where vaccination is general it has become rare and far less fatal.

Etiology.—This is one of the most infectious and most virulent of

transmissible diseases and persons unprotected by vaccination are almost universally attacked on exposure. Second and third attacks are sometimes seen, though rarely. Both these statements should be borne in mind; complete natural immunity, even after repeated exposure is occasionally seen, and a previous attack is not a guarantee of absolute immunity.

AGE.—In unvaccinated communities smallpox is a disease of children and is more fatal than later in life. The fetus *in utero* may be attacked, but only if the mother has the disease. Children born in smallpox hospitals usually escape if vaccinated at once (Osler).

SEX.—There is no difference of predisposition on account of sex.

RACE.—The dark-skinned races are particularly severely attacked by smallpox.

Transmission.—The mode of transmission is not certainly known. Direct inoculation was employed in the early part of the Eighteenth Century in Europe, and from a much earlier period to the present time it has been in use as a protective measure in the Orient. There is a good deal of evidence in favor of aerial transmission, but it is rejected by many authors, notwithstanding the greater incidence of variola in the neighborhood of isolation hospitals in cities.

It seems that flies and possibly mosquitoes may act as carriers, at least in summer. The commonest cause is probably contact or proximity to a case—a proximity close enough to allow the throat and nasal or skin debris to be inhaled by the person infected.

CAUSE.—The cause is not known, although much work has been done on the subject. Various organisms have been described, among others two or three protozoön-like bodies. None of this work is well-confirmed, and it is not generally accepted.

Epidemics.—The prevalence of smallpox is subject to great variations. It smoulders in certain localities for a long time and then spreads like a prairie fire. The contagion can apparently live for a long time in clothing and the like. The mortality and incidence of the disease are steadily dropping in all countries where vaccination is at all general.

There is great variation in the severity of smallpox epidemics, most of those of late years showing so low a mortality that the general public has been loth to accept the disease as genuine smallpox, and by the connivance of some of the less well-informed of the profession it has frequently been called "Cuban itch." It is,

however, true smallpox, and deaths have been by no means so rare as supposed by the laity. In fact several recent epidemics have shown rather a high mortality.

Pathology.—The pustules are to be seen on the tongue and inside the cheeks, on the pharynx, and even down the esophagus into the stomach. Peyer's glands may be swollen, and the rectum may show the pustules.

The eruption in the larynx may be associated with fibrinous exudate or edema, or the cartilages may be involved by ulceration. True pocks do not occur in this locality.

The heart sometimes shows inflammation or degeneration of its muscle. The spleen is enlarged and the kidneys may show nephritis during convalescence.

In the black or hemorrhagic form the skin and mucous membranes, the serous membranes, the tissues of many organs, the connective tissue and the nerve sheaths show large or small clots formed from the blood which has leaked from the vessels.

THE POCK.—The specific lesion according to Councilman and his associates is "a focal degeneration of the stratified epithelium, vacuolar in character, and accompanied by serous exudation and the formation of a reticulum." The most important feature of the pock from a diagnostic standpoint is its regular evolution from papule through vesicle and pustule to crust. Another important point is the presence of the reticulum or network within, which is readily to be seen on picking with a needle.

Incubation.—9 to 15 days; most often 12 days.

Symptoms.

Variola Vera.—STAGE OF INVASION.—Convulsions in children and a chill in adults commonly are the first symptoms noted. The chill may be repeated more than once in the first 24 hours. Intense frontal headache and lumbar pain accompanied by vomiting are very constant at this stage. These pains, with those in the limbs, are more severe than in any other of the eruptive fevers, and when combined with the other symptoms mentioned should at once lead to the suspicion of smallpox. The temperature curve is very sharp and reaches 103° or 104° by the end of the first day, or even sooner. The pulse is full, rapid, not often dicrotic. Delirium may be marked. There is mental distress, with bright clear eyes and flushed face, and in severe cases, delirium. In place of the usual

dry skin, there may be profuse sweating. The severity of the initial symptoms is not a guide to the ultimate severity of the case.

Initial Rashes.—There are two forms of initial rash, one resembling *scarlet fever* and the other *measles*. Either form may have petechiæ associated and may occupy a limited surface or may be general. As a rule they are limited to the lower abdomen, the inside of the thighs, the sides of the chest or the armpits. Sometimes they may be found on extensor surfaces, as the knees or elbows. These rashes are found in from 10 to 16 per cent of all cases, and the scarlatinal form may appear as early as the second day.

Eruption.—*Discrete Form.*—Usually on the fourth day spots or *macules* appear on the forehead, preceded sometimes by a red flush, and on the front of the wrists. Within 24 hours they appear on the remainder of the face, on the extremities, and a few show on the trunk. These spots are from 1/20 to 1/12 inch in diameter, and disappear completely on pressure. With the appearance of the rash, the fever drops, the pain ceases and the patient feels in every way better. On the fifth or sixth day the papules are changed to vesicles with a clear apex. These vesicles are elevated, circular, and have a tiny depression or umbilication in the center.

About the eighth day the vesicles, by the entrance of pus organisms, are transformed into pustules; the umbilication disappears; the pustule becomes globular and grayish white instead of clear. The skin about the pustules is reddened and between pustules is swollen. A new rise of temperature occurs and the secondary fever begins. The general symptoms return. The face and eyelids are swollen, the latter often closed. The temperature in the form under consideration does not often remain high more than 24 to 36 hours, and by the tenth or eleventh day the fever disappears and convalescence begins. The pustules dry in the order of appearance and maturation, first on the face and afterwards elsewhere.

Distribution of Rash.—The upper part of the back is often thickly dotted while the lower part has scarcely any. The abdomen, groins and legs are least affected. Vesicles in the mouth, pharynx and larynx cause swelling of the mucous membrane and loss of voice or hoarseness. Pitting is not usually severe in this form of smallpox.

Confluent Form.—The initial symptoms are the same as in the discrete form, but often more severe. The rash also appears on

the fourth day (sometimes on the third). The papules are isolated, though in the severe cases very close together. The skin is swollen and congested, and the papules are thick on hands and feet, less so on the limbs and still discrete on the trunk. The eruption marches as before, though the remission which comes with the rash is not so pronounced as in the discrete form. On the eighth day, the fever again comes up, maturation takes place, and by the tenth day all of the areas which are to become confluent will do so. The pustules coalesce in these localities to form great superficial abscesses which may involve the head and face or any or all of the extremities.

The fever is high—105° or sometimes higher, the pulse 110 or 120, and there is often delirium. The thirst is severe. In adults there may be salivation, in children severe diarrhea. The cervical lymphatics are greatly swollen. The eruption inside the mouth may be severe, and the voice is husky or lost.

This picture is one of the most terrible seen in any hospital, and a single glance by a layman would be enough to counteract the effect of a library of anti-vaccination literature.

In fatal cases by the tenth or eleventh day the pulse becomes more rapid and feeble, there is marked delirium, twitching of the tendons supervenes, sometimes diarrhea is present, and the patient succumbs. Sometimes hemorrhagic features come up at the time of maturation between the eighth and tenth days.

Desiccation.—The pustules are broken, and the pus runs out, or they dry and form crusts. This proceeds during the third week, beginning usually on the eleventh or twelfth day. The secondary fever usually subsides as this goes on, but may persist into the fourth week. In confluent smallpox the crusts are very adherent, and the process of healing may take several weeks. On the face the crusts are shed singly, but on the hands and feet the epidermis may be shed in large sheets or entirely.

Hemorrhagic Forms (Purpura Variolosa).—In this variety of smallpox the disease starts in the usual manner, but the constitutional symptoms are more intense. On the evening of the second day or the morning of the third there is a diffuse congested rash, particularly in the groins with fine points of hemorrhage. The rash extends, becomes more distinctly hemorrhagic, and the spots increase in size. Blood spots appear on the conjunctivæ, and as early as the third day there may be hemorrhages from mucous mem-

branes. Death may take place before the papules appear. The whole body may be purplish or plum-colored. The face is swollen and the effusions of blood into the eyes give a peculiarly ghastly appearance. The mind remains clear. In Osler's 13 cases, death took place no earlier than the third day and no later than the sixth. There may be no mucous hemorrhage, or it may occur from the lungs, stomach, kidneys or uterus. The pulse is often rapid, hard, and small. Respiration is very rapid and out of proportion to the fever.

Variola Pustulosa Hemorrhagica.—This form, that of hemorrhage into the pocks, has already been mentioned. The bleeding first occurs into the areolæ around the pocks and the pustules fill them with blood. Bleeding from mucous membranes is common and most cases prove fatal from the seventh to the ninth day, but recovery occurs rarely. If patients with discrete smallpox are allowed to get up too soon, hemorrhage may occur in the pocks on the legs, a condition which is not to be confused with the above.

Abortive Types.—Most late epidemics have been characterized by the great percentage of mild cases. Even in unvaccinated children the disease has been almost trifling as a usual thing, with only a few pustules, and a course of a few days only. A type known as wart or horn-pox in which the vesicles do not suppurate but dry up instead at the fifth or sixth day has been somewhat common. *Variola sine eruptione* in which the preliminary symptoms of backache, headache, vomiting and pains in the limbs are present, but the eruption is either absent or so scanty as to be overlooked, has been observed, particularly among physicians and attendants in smallpox hospitals.

Varioloid.—Varioloid is smallpox modified by vaccination. It may have an abrupt onset with the usual symptoms of smallpox and a temperature reaching 103°, but ordinarily the initial symptoms are milder than in unmodified variola. The papules appear on the evening of the third day or on the fourth, are few in number and usually confined to face and hands. The fever drops at once and the patient becomes comfortable. The vesiculation and maturation take place rapidly without secondary fever. There is usually little scarring. For persons attacked within 5 or 6 years of a successful vaccination the rule is to have the disease in a mild form, but it may be severe or even fatal.

Complications.—The complications of smallpox are few, considering the severity of the disease.

Laryngitis.—This may produce fatal edema of the glottis, may cause necrosis of the cartilages, or may favor the aspiration of irritating particles into the bronchi or air-cells, causing bronchitis or broncho-pneumonia.

Broncho-pneumonia is almost always present in fatal cases.

Lobar pneumonia is uncommon.

Pleurisy is sometimes seen, and is common in some epidemics.

Heart complications are rare. At the height of the disease an apical systolic murmur may be heard, but endocarditis, either simple or malignant, and pericarditis are rarely seen. Inflammation of the heart muscle is more frequent and may be associated with endarteritis of the coronary arteries.

Parotitis is rare. There may be an exudate like that of diphtheria in the throat in severe cases.

Vomiting while constant in the early stages is not often persistent.

Diarrhea is common and very constantly present in children.

Albuminuria is frequent; true nephritis is rare.

Nervous symptoms are very important. The convulsions of children are quite regularly present, and in adults the early delirium may become constant and violent, finally subsiding into fatal coma. *Insanity* and *epilepsy* are sometimes sequelæ. A *toxic neuritis* like that of diphtheria may follow the disease.

Boils, acne, ecthyma and local *gangrene* of the skin may occur during convalescence as a result of persisting micro-organisms belonging to the secondary infection.

Recurrent smallpox, a secondary eruption occurring after the desquamation is sometimes seen.

The eyes are frequently attacked by iritis, conjunctivitis, and corneal ulcers.

Middle ear inflammations are occasionally seen, the infection passing in from the throat through the Eustachian tube.

Diagnosis.—During an epidemic the initial chill, backache, headache and vomiting will at once put the physician on his guard, but if dengue or influenza is present in the community, he will be in doubt until the appearance of the papules. The initial rash may resemble scarlet fever, measles or dengue, and be still more a cause of confusion. The scarlatiniform rash has rarely the extent and

THE FOLLOWING VERY EXCELLENT TABLE OF COMPARATIVE SYMPTOMS OF SMALLPOX AND THE DISEASES WHICH MIGHT BE MISTAKEN FOR IT IS FROM A BULLETIN OF THE PUBLIC HEALTH AND MARINE HOSPITAL SERVICE ENTITLED "PLAN OF ORGANIZATION FOR SUPPRESSION OF SMALLPOX IN COMMUNITIES NOT PROVIDED WITH AN ORGANIZED BOARD OF HEALTH," BY C. P. WERTENBAKER, SURGEON P. H. AND M. H. S., WASHINGTON, 1900:

	Smallpox.	Chicken pox.	Measles.	Scarlet fever.	Cerebrospinal meningitis.	Impetigo contagiosa.
Incubation.	*14 days.*	*12 to 14 days,*	*7 to 14 days,*	*Usually 14 days*	*Not known.*	*Not known.*
Invasion.	Chill or chilly sensations. Headache and backache usually severe. Vomiting. Temperature 102° to 104° F.	Mild, may be slight headache. Child is fretful and a little feverish.	Begins with a coryza, and chilly sensations. Soon fever appears and may be intense. Eyes are suffused, injected and distinctive. Sneezing, sore throat, husky voice.	Rigors or distinct chill, headache, pain in back and limbs, followed quickly by intense heat, with pulse 120-130. Temperature 103° to 105° F. Nausea and vomiting.	Variable. In some lassitude, dull headache, vomiting. In others abrupt, sharp chill, coma, and death. In others chill, severe occipital headache, backache, and pain in upper part of spine. Stiff neck, opisthotonos, temperature low, pupils unequal in size, strabismus, nervous and muscular disturbance.	No symptoms of note,
Initial Rash.	Present in 13 per cent of cases; appears on side of chest, groin, and under side of thighs.	*Rare.*	*None,*	*None.*	*o.e.*	*None.*
Eruption.	Appears on 3d day of the disease. Appears first on forehead or cheeks. In 24 hours becomes papular, then vesicular, and finally pustular. Umbilication occurs about the 4th day of the eruption (7th of disease). Eruption conical with rounded or flattened tops. Progresses steadily. Desiccation commences on 9th day. Desquamation on the 14th day of eruption, and is completed in from 10 to 20 days more.	After some 24 hours of malaise, eruption appears. 1st on back or cheek. From 25 to 200 in number. Usually discrete. Macules which in from 10 to 20 hours become vesicles and possibly pustules; usually globular and pearly, becoming yellowish with pustulation. Comes out in crops, a new crop every two days. Lasts from 7 to 9 days.	Eruption appears within 2 to 4 days. 1st on face, neck, and body, then legs and arms; lastly on back of hands. Eruption consists of little fine red crescentic dots crowded into irregular patches; the skin between the patches being normal. The odor is peculiar. Color varies from rose red to mahogany. Epistaxis common. Eruption begins to fade in about 4 days from the time it appeared on face. It usually takes 4 days to spread over body after it has appeared on face. Commences to fade where it first appeared and leaves a brownish stain on the skin. Desquamation lasts about a week. The skin comes off in fine scales (bran-like) desquamation. Disease lasts about 8 days,	Appears in about twenty-four hours and all symptoms increase in severity. "Strawberry tongue" appears. Throat sore and red. Skin hot and dry, eyes suffused. Eruption appears as red dots, first on neck and cheek and extends over the entire body. Vomiting is projectile in character. Eruption begins to fade by 4th day and disappears by the 8th day, when desquamation commences and lasts about 14 days. Disease lasts from 14 to 21 days.	Variable in appearing. Is hepetic in character and usually limited to full lips and neck. Sometimes is petechial in character and scattering over the entire body. Duration of eruptions variable.	Vesico-pustules from the first, appear in crops. Averages size of a split pea. Have red halo on skin which soon fades. If eruption is not disturbed commences to dry up—change to straw yellow granular crusts which appear "stuck on." Eruption superficial, seldom leaves pits. Is auto-inoculable; eruption usually on face, chin, hands, or exposed parts of body. Rarely general. Duration several weeks. More frequent in warm weather.

never the persistence of the rash in true scarlet fever. Measles may be mistaken for the preliminary rash of smallpox, but Koplik's sign will at once differentiate.

Hemorrhagic Smallpox, Hemorrhagic Scarlet Fever and *Hemorrhagic Measles* may be impossible of differentiation, but to the sanitarian the point is rather academic than otherwise, because the same measures are required for prophylaxis, and the cases which cannot be recognized are the ones which die before the disease is properly developed.

A peculiar odor is by many said to be characteristic of smallpox.

Chickenpox shows points of difficulty in connection with the mild epidemics of smallpox seen of late years. The eruption of chickenpox is more superficial, the feel is less shotty or not at all so; the areola of injection is less marked, and there are usually successive crops in various stages.

Pustular Syphilides if accompanied by fever are sometimes mistaken for smallpox, but the history of the case and distribution of the eruption should leave no doubt.

Pustular Glanders in a Montreal epidemic (Osler) was confused with smallpox. The presence of the glanders bacillus (B. mallei) should at once settle the diagnosis. An incidental point would be the occurrence of an epizoötic of glanders among horses.

Impetigo Contagiosa and smallpox have sometimes been confused.

Prognosis.—In unvaccinated whites the mortality is 25 to 35 per cent; in negroes, 42 per cent, and in the red and Malay races, for which figures are not now ascertainable, it is very high.

The prognosis for the individual is based on the thickness of the eruption on the face and hands, and is bad directly proportional to its severity. The eruption on the remainder of the body is disregarded for this purpose.

Individual Prophylaxis.—Vaccination and revaccination.

Community Prophylaxis.—Vaccination of all children within the first year of life, whether smallpox is prevalent or not, and revaccination at intervals of a few years through life, are the surest means of protecting the community.

Isolation of the sick in proper hospitals is of great importance.

Quarantine.—*For the Sick.*—Until desquamation is complete and the skin thoroughly healed, not less than 21 days.

For Contacts.—Quarantine for 14 days. Vaccination and sur-

veillance may be substituted in selected cases, if permitted by the rules of the State Board of Health.

Disinfection.—The patient must have a soap and water bath, paying particular attention to the hair, followed by a 1:2000 bichloride bath on two successive days after desquamation is complete. One room is disinfected and within it are placed a complete change of clothing for the patient. The patient walks nude from the bath to the disinfected room, puts on the clothing, and is released from quarantine. After arranging the rooms for disinfection, the nurse takes an antiseptic bath following a thorough soap and water scrub—paying attention to the hair, starts the formaldehyd or sulphur fumigation (formaldehyd being preferred), changes into clean or disinfected clothing in the disinfected room, and the house is exposed to the action of the disinfectant for at least 12 hours.

VACCINIA.

Synonyms.—Vaccination; Cowpox.

Definition.—An infectious, eruptive disease of cattle, which, when communicated to the human species, protects partially or more generally completely for several years against smallpox. The acquirement of this immunity is signalized by the appearance of a local reaction or *vaccine pock,* and by more or less severe general symptoms.

Etiology.—Experiments in Great Britain and in India seem to prove that the inoculation of true smallpox virus into the cow carried through one or two generations will produce vaccinia or cowpox. At one time this method was used commercially on quite a scale for obtaining commercial vaccine. It is mentioned here as in isolated places remote from facilities for obtaining vaccine it might enable the sanitarian to produce his own supply. Such a supply, produced hurriedly in the presence of an advancing epidemic, with poor facilities for aseptic care of the animals and for purifying the product, would be much inferior to the best commercial vaccine, but the experiment is worth considering under appropriate circumstances.

On the other hand, certain other experiments of the same nature carried on in France seem to contradict these statements, since true smallpox was apparently transmitted when the virus was rein-

oculated into children. Nevertheless, the weight of evidence is in favor of the first view.

A protozoön-like body having characteristics like those supposed to have been found in smallpox, has also been found in vaccinia, according to some observers, but as in the case of smallpox, these observations have failed to find acceptance with the great body of pathologists.

Normal Vaccination.—Period of Incubation.—This is marked by nothing more than a slight local irritation due to the abrasions made in the operation of vaccination.

Eruption.—On the third day, sometimes not until the fourth, a small papule appears, surrounded by a reddish areola. This increases and on the fifth or sixth day is transformed into a true vesicle, with raised margins and depressed center. This vesicle reaches the maximum on the eighth day, when it is round and filled with clear fluid, with hard and prominent margin and even more distinct umbilication. On the tenth day the contents are purulent and the surrounding red zone is extensive. On the eleventh or twelfth day the congestion diminishes, the contents of the pock grow more opaque and begin to dry. At the end of the second week in typical cases nothing is left but a brownish scab, which in another week or ten days drops off, leaving a circular pitted scar.

Constitutional Symptoms.—Usually on the third or fourth day there is a rise of temperature which may persist for 4 or 5 days longer; there is leucocytosis, quite marked; in children restlessness and irritability, particularly at night; the tributary lymphatic glands near the site of the inoculation are often enlarged and painful.

Duration of Immunity.—This may be permanent but ordinarily is not longer than 10 or 12 years, and in the presence of smallpox revaccination should be done regardless of the date of previous inoculations. In the United States Army and Navy, revaccination is required at frequent intervals, with the result that smallpox is extremely rare, although the duties of soldiers and marines take them into many places where the contagion of smallpox is likely to be found.

Natural insusceptibility to vaccination is sometimes seen, where the freshest virus most carefully applied repeatedly fails. Such cases are probably also immune to smallpox, but should be vacci-

nated at each recurrent epidemic as there is no means of knowing when this natural immunity may lapse.

Local Variations.—The vesicle occasionally develops rapidly with much itching, is not characteristically flattened, and progresses to the crust by the seventh or eighth day. Sometimes the contrary is true and the process goes on with abnormal slowness. In the second case revaccination with a proved fresh lymph is advisable. Also the contents of the vesicle may be watery or bloody, or very rarely a second pock may form at the site of the first, a process comparable to recurrent smallpox.

Generalized Vaccinia.—Not uncommonly secondary vesicles may form near the primary, and more rarely there is a general pustular rash, covering considerable portions of the body, but beginning usually on the wrists or back and sometimes appearing in successive crops for several weeks. The eruption is most prominent on the vaccinated limb as a general thing and begins on the eighth or tenth day. In children vaccinia of this type has extremely rarely caused death.

Complications.—The most common complications are the result of secondary inoculation of pus cocci, tetanus bacilli or similar organisms as the result of injury or uncleanliness.

A depressed state of the general health has been thought to favor infections of this nature. There may be sloughing, deep cellulitis, suppuration of axillary or inguinal lymphatic glands, or purpura.

The complications are arranged chronologically by Acland, thus:

First 3 days: erythema; urticaria; vesicular and bullous eruptions; invaccinated erysipelas.

Fourth day to maturity of pock: urticaria; lichen urticatus; erythema multiforme; accidental erysipelas.

About end of first week: generalized vaccinia; impetigo; vaccinal ulceration; glandular abscess; septic infections; gangrene.

After involution of pock: invaccinated diseases, as for example, syphilis.

Tetanus.—Tetanus being practically always an accidental infection, the time of its appearance is not to be predicted. Ninety-five cases of vaccination tetanus are recorded by McFarland, nearly all occurring in the United States. Sixty-three of these cases occurred in 1901, most of which could be traced to a single source, from which the tetanus organism was recovered. Since the *Bacillus tetani* is normally present in the intestines of cattle, the chance of

contaminating the lymph is always present. It is not fair to charge the operation of vaccination with all of this mortality, however, as similar slight wounds are not infrequently contaminated by accident with subsequent development of tetanus.

Tuberculosis.—The British Royal Commission on Vaccination was unable to find a single instance of undoubted invaccination of tuberculosis, so that if it occurs it must be excessively rare.

Actinomycosis.—No reports of ray-fungus ("lump-jaw") infection are available, but the organism has been found in 24 out of 95 cultures from the product of 5 different producers.

Choice of Lymph.—All of the commercial lymphs now sold in the United States, whether produced at home or abroad, are produced in establishments licensed by the National Government, and inspected at frequent irregular intervals by officers of the Public Health and Marine Hospital Service. Each lot of lymph is required to be bacteriologically tested, and is obtained and treated as follows:

Perfectly healthy calves are selected. The posterior half of the belly is shaved, cleansed, scarified in parallel lines, and inoculated with mature virus. The vesicles form along the lines of scarification; when mature (about the eighth or ninth day) their contents are removed under the strictest aseptic precautions, mixed with glycerin and allowed to "ripen" for 4 to 6 weeks. It is frequently tested for potency and freedom from contamination, and if it meets the government requirements is prepared for market—either dried on ivory points or put up in small glass tubes. The capillary tubes containing only sufficient for one inoculation or the ivory points are preferable to the tubes containing residual pulp left from the glycerin extract. As an additional safeguard, some if not all of the large commercial houses kill the animals and subject them to autopsy before marketing the lymph. Special care and tests are used to insure freedom from tetanus bacilli in the finished product. Each package of lymph is stamped with a date of expiration beyond which the percentage of takes is likely to be unsatisfactory, and is traceable through its entire history by the manufacturer's guarantee number and serial package number.

Economy of Production.—A report of the British Local Government Board states that whereas formerly it was only possible to obtain material for from 200 to 300 vaccinations from a calf, since the introduction of glycerinization it is possible to obtain

from 4,000 to 5,000 units from one animal. While this would seem to make the retail price of vaccine lymph too high, it must be remembered that for a plant to produce a good article it must be expensively equipped, employ a considerable number of experts and stand large "overhead" expenses. The return privilege for unused out-of-date vaccine is also an expense met by the consumer, and the commercial profits of the drug-store must be paid.

Humanized Lymph.—The use of human lymph is almost unknown in the United States of recent years, but in remote districts its use may be necessary in order to eke out a scanty supply of animal lymph. It is not to be recommended except in the presence of a real emergency, on account of the ease with which other diseases, particularly syphilis, may be communicated. Human vaccine lymph should be taken from a perfectly healthy child, from unbroken and perfectly formed pocks, on the eighth day. The surface should be carefully pricked or scratched, allowing the lymph to exude, but using scrupulous care not to draw blood. This lymph is collected on ivory points or better in capillary tubes and is used in the same manner as the bovine lymph.

Time and Method of Vaccination.—In the presence of smallpox epidemics, infants of any age may be vaccinated. If there is no pressing need, vaccination is best delayed to the age of 4 to 6 months if children are healthy, and in sickly babies it may be delayed to the age of 1 year.

A baby is best vaccinated on the outer side of the calf of the left leg if the mother is right-handed, or in the same place on the right leg if left-handed, for the reason that in handling the child or holding it the inoculation will then be most naturally held away from contact with the mother's body (Mathewson). The leg is the preferable site rather than the arm, for the reason that the abundant lymphatics of the groin control better the inflammatory reaction following than do the less developed ones of the axillary region.

Women in society usually prefer the calf of the leg also for cosmetic reasons. In right-handed men the left arm is most often chosen, a spot being selected on the outer side 5 or 6 inches below the top of the shoulder.

The desired spot should be well scrubbed with sterile soap and boiled water, using a soft sterilized brush or piece of sterile gauze. After scrubbing, the skin should be washed again with alcohol and allowed to dry thoroughly. It must be remembered that any anti-

septic in the skin will defeat the object of the vaccination. For this reason alcohol, which is a volatile antiseptic, is chosen and allowed to evaporate after having done its work.

A fine cambric needle is inserted by the eye-end into a cork and sterilized by heating to redness in the flame of an alcohol lamp and after cooling, the skin is cross-hatched over an area half the size of a dime, aiming to break the lymphatic channels but without drawing blood. Ivory points may be used in the same way, or little metal scarifiers supplied with the packages of lymph, but the needle is to be preferred.

Army orders require 3 areas to be scarified and inoculated in a triangle about 2 inches on a side. This is to be recommended in the case of smallpox contacts.

After scarification, the lymph is applied and allowed to dry before any dressing is put on. This may be a celluloid shield which holds the clothing from contact with the vaccination, but does not itself touch it anywhere, or it may be a simple pad of sterile gauze held in place by zinc oxide plaster.

After Care.—If a gauze dressing is applied, unless soiled it should not be touched till the third or fourth day, when the "take" occurs. This should be smeared over with zinc oxide ointment and a new sterile dressing put on. If infection seems to be occurring, a wet bichloride dressing, 1:2000, should be put on. If a shield is used it is often possible to let a case get completely well before touching the dressing, otherwise it may be treated as above.

Satisfactory takes are much easier to recognize than to describe. If the appearance of the "take" is not satisfactory, revaccination should be done.

Perfect scars according to Welch and Schamberg are "round or oval, below the level of the surrounding skin, with well-defined margins, pitted or reticulated, and looking as if stamped into the skin. Large flat scars are not signs of a good take, but of infection of the vaccination wound; large pits about the edges of a scar are a good sign of a take; the smaller pits scattered over the surface of a large flat scar are generally the dilated mouths of hair-follicles and sebaceous glands."

Vaccination by Mouth.—A few physicians unfamiliar with the real processes involved in vaccination and pushing a therapeutic dogma to extremes, have given triturations of vaccine matter with sugar of milk by the mouth, with the idea of thereby securing the

same result as by the classical method of vaccination. The health officer will look with suspicion on certificates of vaccination issued by any physician known to entertain such views, and will investigate the presence of a scar or otherwise ascertain if the so-called vaccination has been of this description. The administration of vaccine matter by the mouth has been held by the courts not to comply with the legal requirements where vaccination is made compulsory for any purpose, and it can on no account be accepted as a vaccination from the standpoint of the sanitarian. Those who give certificates of vaccination based on it should be prosecuted.

Objections.—The objections to vaccination, with their answers are well summed up by Mathewson:

It is Dangerous.—The dangers of vaccination exist chiefly in the minds of the opponents of vaccination. The chief source of danger remaining is an accidental infection of the wound caused by the vaccination. In this a vaccination wound but shares in the danger of any wound to infection. This in vaccination amounts to 1 case of fatal infection in 65,000 cases. Voight reports 2,275,000 cases in Germany with a total of 35 deaths. Recently he reports 100,000 cases with but one death. Hodgetts reports 40,000 vaccinations done in the Province of Ontario, Canada, without a death. These statistics show that vaccination is less dangerous than the extraction of a tooth or the taking of an anesthetic.

It is Useless.—This statement is based on the undenied fact that vaccinated persons sometimes have smallpox. The protection of vaccination becomes exhausted, and the disease is contracted; or the person is exposed to smallpox, is vaccinated, and has the disease in spite of the vaccination. Prussia is the most thoroughly vaccinated nation in Europe, and from 1874 to 1901 inclusive, there died from smallpox 1.3 persons per 100,000 as against 42.1 persons per 100,000 under voluntary vaccination, and approximately 1 in 7 in the days before vaccination. No case of smallpox has ever been known to occur in a person recently successfully vaccinated. Attendants in smallpox hospitals are vaccinated and revaccinated frequently and smallpox is unknown among those so protected.

At the Highgate Hospital near London, where hundreds of smallpox patients are treated, but one attendant in the past 60 years has taken smallpox, and that attendant was a gardener who was not vaccinated because he did not come in contact with the patients.

The mortality among the vaccinated is as 1 to 7 among the un-

vaccinated, as shown by the following table from the reports of the British Royal Vaccination Commission:

	Cases.	Deaths.	Per Cent.
Vaccinated	8,744	461	5.0
Unvaccinated	2,321	822	35.1

It is an Invasion of the Rights of the Individual.—There is no answer to this argument if we grant that the individual has a right to do as he pleases. This may be granted if the individual lives alone and comes in contact with no other human being. Life in communities invades and restricts the right of the savage, and community life is impossible on any other terms. The police power of the community rests on either the public nuisance or the public welfare ideas in common and constitutional law, i. e., an individual may not maintain a public nuisance and a group of individuals may act together for the public welfare. Compulsory vaccination laws, where they exist have been upheld unanimously by all courts of appeal before which they have been tested, and the right of the community to enforce vaccination for the public welfare has been established. The individual who in exercising his right to do as he pleases contracts smallpox is conveyed to a pesthouse as a public nuisance, and his family is quarantined for the public good.

Doctors Favor It for the Fee that They Get for Vaccination.—This trifling argument may be answered thus: Vaccination is usually performed free of charge by sanitary officers, and the cost is borne by the city or State wherever vaccination is compulsory. Where vaccination is voluntary and paid for by the individual, a physician will receive more for the treatment of one moderately severe case of smallpox than for 100 vaccinations.

All Smallpox Statistics are False.—Whether or not statistics are kept, smallpox does exist and kills or scars its victims and the fact of its existence and the danger remain, even if the disease is disguised under the name of measles, chickenpox, Philippine or Cuban itch, or any other designation.

Compulsory Vaccination.—Laws compelling vaccination are in force in many countries and in many States and cities in this country. The highest standard in the drafting and enforcement of these laws is found in the German Empire, and particularly in Prussia, where every child must be vaccinated during the first year

of life and again during the twelfth year. Later revaccination is not required.

In the United States and its dependencies the most brilliant results are to be found in the Philippine Archipelago, where compulsory vaccination has reduced the mortality from smallpox almost to the vanishing point as against an average death-rate under Spanish rule of 6,000 known deaths per annum. Many States which do not in terms require vaccination, make it a requisite for admission to the schools, and make attendance at school compulsory, which arrives at the same point by a somewhat devious route.

There is not the slightest doubt of the advisability of compelling vaccination of every person from a sanitary point of view. If a strong public sentiment exists against it, the alternative plan of doing away entirely with quarantine for smallpox would afford a demonstration which would convert the most confirmed doubter. Such a plan has been mooted in at least one State and would have its advantages.

The allowing of "conscientious scruples" to exempt one from the operation of such laws, as is the case in Great Britain, emasculates the law and renders it unworkable under American conditions. A law of this kind should allow no exceptions, beyond permission to allow recovery from a poor state of health before vaccination, and this should not be permitted except on the sworn statement of a practising physician. Certificates are regarded rather lightly by some members of the profession, but a sworn document, with the attendant punishment for perjury, would not be given unless circumstances fully warranted it.

CHICKENPOX.

Synonym.—Varicella.

Definition.—An acute infectious disease of children, characterized by an eruption of vesicles on the skin.

Etiology.—This disease is ordinarily epidemic but is occasionally sporadic in prevalence. It is a disease of childhood, attacking by preference between the second and sixth years, but adults who have not had the disease are sometimes attacked. There is no known relation between chickenpox and smallpox, an attack of the one not conferring any immunity against the other. The cause is as yet unknown.

Incubation.—10 to 15 days.

Symptoms.—The first symptom is fever, slight in degree, sometimes preceded by a light chill or rarely by convulsions. There may be vomiting and pain in the back and legs. The eruption is ordinarily first seen on the trunk, either on the back or chest. More rarely it begins on the forehead or face. Red raised papules appear first, generally within 24 hours of the first symptoms. In a few hours these change to hemispherical vesicles containing fluid, either clear or turbid. At the end of 36 or 48 hours from the beginning of the attack, the vesicles are transformed into pustules which are usually also hemispherical, but may be flattened or even umbilicated. In a few more hours these pustules begin to dry and shrivel, and by the end of the third or fourth day are converted into dry crusts which fall off and ordinarily leave no scar.

Varieties.—*Varicella Bullosa.*—The vesicles become large and develop into blebs, like those of ecthyma or pemphigus. If scratched, these lesions are liable to develop into ugly and troublesome ulcers. This is more liable to occur since the blebs itch and burn badly.

Varicella Hemorrhagica.—This has been described as occurring with hemorrhages from mucous membranes and under the skin.

Varicella Escharotica.—In delicate children, particularly the tuberculous, gangrene of the skin surrounding the pocks or of other parts, as the scrotum, sometimes is seen.

Complications.—*Nephritis* may follow chickenpox.

Infantile Hemiplegia has been observed.

Diagnosis.—Ordinarily easy, especially if the case has been seen from the beginning. Cases in adults may be very severe and simulate smallpox closely. In these cases history of exposure to smallpox or the reverse throw much light on the case. If in doubt, vaccinate the contacts and call it smallpox until the contrary is proved.

Mortality.—Usually trifling; deaths being very rare.

Quarantine.—None except for school-children. The patient must be isolated for 14 days or longer, until desquamation is complete. Contact children must be excluded from school for 14 days if not immune through a previous attack.

SCARLET FEVER.

Synonyms.—Scarlatina; Scarlet Rash.

Definition.—An infectious disease of unknown etiology charac-

terized by a diffuse eruption on the skin and a sore throat of varying intensity.

Distribution.—Endemic in most large cities in the temperate zone, and becoming epidemic in all localities in the same latitudes at times.

Etiology.—The specific germ is unknown, although streptococci are found with great constancy.

Pathology.—There are no constant anatomical changes. The rash does not persist after death except in hemorrhagic cases. Other lesions found are partly due to high temperature and partly to associated pus organisms.

Predisposing Factors.—Age under 10 years; 90 per cent of the fatal cases are under that age; nurslings, however, are seldom attacked. Susceptibility to scarlet fever is less general than to measles. Family susceptibility is sometimes seen, when several members of a single family may die in rapid succession.

Mode of Infection.—Not certainly known, but nose and throat secretions, scales from the skin and pus from a suppurating ear have all been known to convey it. It is certainly infectious at a very early stage.

Incubation.—Usually from 2 to 4 days; occasionally 24 hours and sometimes as long as 12 days.

Prodromes.—Not generally noticeable.

Onset.—Usually sudden; vomiting is a very constant symptom; the fever is intense, often reaching 105° the first day; skin dry and very hot to the touch; tongue furred and dryness of the throat may be complained of; the face is often flushed and the patient appears "feverish." Cough and catarrhal symptoms are not usually seen.

Eruption.—On the second day, but occasionally on the first, the eruption appears in the shape of scarlet points under the skin. This may also appear in the roof of the mouth, even before it shows on the skin. In typical cases the skin becomes an intense diffuse scarlet "like red flannel" and the nail drawn over the skin causes an anemic white line, followed in a few seconds by a more intensely red one. The skin, at first smooth, becomes rough and after a day or so, like "goose-flesh." The eruption may not be uniform, but patchy, with areas of normal skin intervening. It may also be indistinguishable except on the most careful observation, and may be very evanescent.

Minute hemorrhages or large purpuric spots may be seen in the severe and malignant forms. The whole skin may be covered with little yellow vesicles on a deep background, so-called *scarlatina miliaris*. There may be tiny papular eruptions, but more rarely than in measles. The rash disappears by the seventh or eighth day.

Mucous Membranes.—The tongue, which is at first red at the tip and edges and elsewhere furred, soon shows the reddened papillæ pushing through the fur to form the rather characteristic "strawberry" tongue. In a few days the fur is cast off and the tongue then looks like a red raspberry. This enlargement of the papillæ of the tongue was the only eonstant sign in 1,000 cases of scarlet fever (McColom).

The pharynx shows symptoms grading all the way from a slight redness to an intense angina with false membrane aceompanied by glandular swelling or even in the severest eases a thiek brawny induration of all the tissues of the neck.

Symptoms.—The temperature may reach anywhere from 103° in the milder cases to 106° in the severer ones, and even 108° and 109° have been recorded before death.

The pulse ordinarily ranges from 120° to 150°, but in the severest cases with high fever may go up to 190° or 200°.

There is a sudden leucocytosis, reaching 18,000 to 40,000. After the initial vomiting, the stomach symptoms subside and generally give no further trouble.

Albuminuria should be looked for every day.

Varieties.—*Mild form.*—In this form the skin eruption if present is very evanescent, the child showing only a slight sore throat. This is the form which makes so much trouble for the sanitarian, as people will not believe either that it is scarlet fever or that is infectious. Nevertheless it may give rise to the next form in any child who may come in eontact with it.

Malignant Form.—Death may oecur within 24 or 36 hours with every symptom of an overwhelming intoxication; the temperature may go to 108° or 109°, with convulsions and delirium, great difficulty in breathing, very rapid and feeble pulse, and death may occur even before the appearance of the rash.

Hemorrhagic Form.—There are hemorrhages into the skin, nose bleed, and bloody urine. While this form more usually attacks feeble children, it sometimes oceurs in adults of previously good health.

Anginose Form.—Throat symptoms appear early with great swelling of fauces and tonsils which are rapidly covered with a grayish exudate, which may extend into pharynx, larynx, nose and mouth, and occasionally into the Eustachian tube, trachea and bronchi. There may be death of the tissues and sloughing. Death is either by toxemia or exhaustion.

Desquamation.—Desquamation usually begins on the tenth day. The peeling-off process lasts from 10 days to 7 or 8 weeks. The scales may be small and "branny" or entire casts of a finger or toe. It seems to bear some relation to the severity of the disease, and what are apparently second desquamations have been known to occur. Sometimes the nails and hair are also shed with the epidermis.

Complications.—NEPHRITIS.—This may begin in the second week or may be delayed to the fourth. It is in three grades:

(1.) *Acute hemorrhagic nephritis.*—There may be suppression of urine or only a small quantity of bloody fluid loaded with albumin and casts; there is vomiting, which is accompanied by severe uremic convulsions and followed by death.

(2.) *Acute nephritis.*—The symptoms are less urgent in this non-hemorrhagic form. The urine is diminished in quantity, smoky in color; shows albumin, tube-casts, a few blood cells, and some blood pigment. The eyelids and ankles are puffy, and there may be effusion into the serous sacs. This condition may drag on and become chronic, undergo a rapid exacerbation with uremia and a fatal termination, or undergo resolution as it generally does.

(3.) *Sub-acute nephritis.*—The urine contains albumin and a few casts, but rarely blood. The constitutional symptoms are mild and recovery is scarcely retarded. Even in this type serious symptoms, such as edema of the glottis or rapid pleural effusion may occasionally supervene.

In either of these last two types recovery may be slow, the child remaining anemic with possibly a little albumin in the urine, and the condition may eventually clear up or pass over into interstitial or chronic parenchymatous nephritis.

ARTHRITIS.—This is of two types; the first being a pyemia with suppuration of one or more joints, which is a very serious and often fatal form. The second is the true scarlatinal rheumatism, analogous to gonorrheal rheumatism, which may attack many joints at once or in succession. It comes on in the second or third week.

There may be purpura, chorea, heart lesions or pleurisy. In this form the prognosis is generally good.

Heart Lesions.—Like the joint troubles, these are of two kinds—the malignant endocarditis sometimes with purulent pericarditis which are rapidly fatal, and the simple endocarditis and pericarditis which often undergo complete resolution. There is also a toxic inflammation of the heart-muscle which is occasionally encountered and which is rapidly fatal.

Chest Lesions.—These are uncommon, except empyema, which is an insidious and dangerous complication.

Ear Lesions.—These are very common and very serious, first from the damage to the ear itself, with resulting deafness, and second, from the danger of extension to the mastoid and meninges or to the brain itself. There may be paralysis from involvement of the facial nerve.

Glands.—There may be an inflammation of the lymph-glands of the neck of any degree from transitory swelling to severe suppuration or long-standing and brawny massive swelling.

Chorea.—Chorea may follow scarlet fever, as may sudden or progressive paralyses.

Relapses.—Relapses were noted in 7 per cent of 12,000 cases and in 1 per cent of 1,520.

Differentiate.—From acute exfoliating dermatitis; measles; German measles; septicemia; diphtheria; drug rashes.

Diagnosis.—The most reliable diagnostic signs are the sudden onset; vomiting; white line followed by red when anything is drawn sharply over the skin; punctate eruption in the mouth; sudden fever; strawberry tongue; high leucocytosis. It must be remembered that any or all of these may be absent. A new sign recently observed by Bastia of Bucharest, but not as yet confirmed, is the presence of two or three bright red lines in the bend of the elbow very early in the disease. He claims that this is constant in scarlet fever, and not found in anything else. It should be looked for.

Coexistent Diseases.—Diphtheria, chickenpox, whooping cough, measles, erysipelas, typhoid and typhus have been noted in connection with scarlet fever.

Mortality.—From 5 to 10 per cent in mild epidemics and from 20 to 30 per cent in severe ones. One thousand cases in the Boston City Hospital gave 9.8 per cent.

Persistence of Infection.—15,000 cases in Glasgow isolated 49

days or under showed a percentage of "return cases" from the same families of 1.86 per cent; from 50 to 56 days, 1.12 per cent; from 57 to 65 days, 1 per cent.

Quarantine for Contacts.—12 days. If possible non-immunes should be isolated in another house.

Quarantine for Convalescents.—Until desquamation is absolutely complete, a minimum of 21 days and a maximum of 8 weeks; with a running ear, the child should be excluded from school much longer than 8 weeks and should under no circumstances return to school under 5 weeks. In most states the quarantine is of the modified degree. Treatment in a special hospital is most desirable from a sanitary as well as a medical point of view.

Disinfection.—Before discharge from quarantine patient should be given antiseptic baths on two successive days, after which the disinfection proceeds in the ordinary manner. Formaldehyd is the preferred disinfectant.

Community Prophylaxis.—School inspection daily, restriction of attendance of children at public gatherings, careful administration of quarantine and scrupulously careful disinfection are the main reliance in the control of scarlet fever. Medical attendants must not take surgical or obstetrical cases. Funerals must be private, and the dead must be buried within 24 hours. They must not be shipped to other places except under the most stringent precautions.

Sera.—Various antistreptococcic sera have been recommended for prophylaxis and treatment. In severe epidemics they are worth trying, not as a means to prevent the primary infection but to cut short the secondary infection. It should not be forgotten that a rash may follow the injection of horse serum which may be confounded with scarlet fever.

MEASLES.

Synonyms.—Morbili; Rubeola.

Definition.—An acute, highly contagious fever with specific localization in the upper passages and in the skin. (Osler.)

Etiology.—The specific cause of this disease is unknown. Recent experiments on monkeys have demonstrated that the virus is filtrable through porcelain bougies capable of holding back all known bacteria.

Direct contagion is the most common method of contracting

the disease, but mediate infection carried in the clothing of persons going from the sick-room is more common than generally believed, outside the ranks of those who have given the matter special study. Osler goes so far as to state that infection by fomites is very common, an assertion with which most sanitarians would agree.

An important point to remember is that it is contagious sometimes two or three days before the breaking-out of the eruption, being evidenced only by the slight catarrh of the respiratory passages and a slight redness of the eyes.

Susceptibility to measles is universal in childhood and among adults who have not had the disease in childhood. Infants under the age of three months have a relative immunity, but children may be born with the measles eruption or develop it within a few days after birth.

This disease is more dreaded than smallpox by military and institutional sanitarians because of the difficulty of taking effective measures against it.

Pathology.—The catarrhal and inflammatory changes have nothing characteristic. The fatal cases are usually killed by broncho-pneumonia and intense bronchitis. The lymphatic elements all over the body are swollen. During convalescence previously latent tuberculosis is liable to become active.

Incubation.—From 7 to 18 days, oftenest 14. No special symptoms are to be observed during this period.

Onset.—For 3 or 4 days, sometimes a day or two longer, the child presents the features of a feverish cold. The onset may be insidious or more rarely abrupt with even a convulsion. There is not often a definite chill. Severe cases may begin with headache, nausea and vomiting. The fever is slight at first but becomes burning, with congestion of the skin. The catarrhal symptoms are exaggerated, with running nose, coughing and sneezing, redness of eyes and lids, and avoidance of the light. There may be a preliminary eruption of flat red spots or blotches on the skin, but this is unusual. The tongue is furred and the mucous membrane of the mouth reddened. The fever may rise abruptly but more frequently takes 24 to 48 hours to reach its height. The pulse-rate runs high, up to 140 or 160 per minute, declining with the fever.

Eruption.—Sydenham's classical description cannot be improved upon. "The symptoms increase till the fourth day. At

that period (although sometimes a day later) little red spots, just like flea-bites begin to come out on the forehead and the rest of the face. These increase, both in size and number, and mark the face with largish red spots of different figures. These red spots are formed by small red papules, thick set, and just raised above the level of the skin. The fact that they really protrude can scarcely be determined by the eye. It can, however, be determined by feeling the surface with the fingers. From the face, where they first appear, these spots spread downward to the breast and belly; afterward to the thighs and legs." The papules are rather shotty in feel, but do not extend deeply. The color of the eruption is less uniform and the swelling of the skin is less intense on the trunk and extremities. On the other hand, the mottled blotchy character of the eruption is more marked on the chest and abdomen. The eruption is hyperemic and tends to disappear on pressure except in malignant cases, in which it is deep rose or purple, and does not disappear.

The general symptoms do not much abate with the appearance of the eruption, but persist until the end of the fifth or sixth day. Miliary vesicles or petechiæ are occasionally seen. The "recession" of the rash which was formerly considered the cause of death in measles is interpreted by Osler to be merely a sign of the failing circulation which really causes death.

Koplik's Spots.—These are white or bluish-white spots, surrounded by red areolæ, on the inside of the cheek opposite the line of closure of the teeth. They are extremely constant and are to be found even before the appearance of the rash. They should be looked for in a good natural light, and the sanitarian should familiarize himself with their appearance.

Eosinophilia.—In doubtful cases of measles, the presence of a distinct eosinophilia may help to clear up the diagnosis, if facilities for a blood examination are at hand.

Desquamation.—The desquamation is in fine scales, more rarely in large flakes. It is in proportion to the extent and severity of the rash. Its completion may take a few days only or extend to several weeks.

Atypical Forms.—Attentuated.—The child is well by the fifth day.

Abortive.—The initial symptoms are present, but no eruption follows.

Malignant, Black, or Hemorrhagic.—This occurs most frequently in large epidemics and in institutions, and in children rather than adults. Hemorrhages occur in the skin and mucous membranes, and from mucous membranes; there is very high fever and all the symptoms of the most profound intoxication are present, with cyanosis, difficult respiration, and heart weakness. Death occurs from the second to the sixth day.

Complications.—Nose-bleed.—Sometimes a serious complication.

Laryngitis.—Not uncommon; the voice is husky and the cough croupy.

Bronchitis and Broncho-pneumonia.—The bronchitis is so constant as to be an integral part of the disease, and the possibility of its extension to the bronchioles must always be borne in mind. Broncho-pneumonia is the cause of the greater part of the mortality in measles.

Lobar pneumonia.—This is less common than the foregoing.

Parotitis occurs occasionally.

Gangrenous stomatitis is sometimes seen, especially in run-down children in institutions. It is a frightful condition in which death is less to be feared than recovery.

Diarrhea is a very troublesome feature of some epidemics.

Nephritis occurs less frequently than after scarlet fever, but more commonly than usually thought. The urine should be watched.

Whooping cough occurring with or following measles is a complication to be dreaded.

Other rare complications occur, for which the reader is referred to any standard work on pediatrics or practice.

Prognosis.—This disease ranks third in death-rate among the eruptive fevers. The case death-rate is not high, but owing to the large number of cases and the wide-spread susceptibility to the disease, the total is very large. The death-rate is, however, not so much due to the measles as to the complications. In a virgin soil the proportion of deaths is frightful, as in the Fiji Islands where 40,000 out of 150,000 inhabitants died in four months.

Immunity.—Immunity is almost invariably conferred by one attack, and so-called second attacks are nearly always due to mistakes in diagnosis.

Diagnosis.—During the prevalence of an epidemic the disease is easily recognized, but mistakes occur, as for instance in the sending of measles cases to smallpox hospitals. Usually the isolation of

the patient and observation of the development of the eruption for a few hours will settle the question definitely one way or the other. Koplik's spots and the eosinophilia should not be forgotten. Copaiba and antidiphtheritic serum give a rash much like that of measles, but antipyrin, chloral and quinine rashes ordinarily present no difficulty. Malignant measles may resemble typhus also.

Prophylaxis.—This is a most difficult disease to handle, as the long period of incubation and the four days of infectiousness before the eruption appears, together with the refusal of the laity to regard it seriously, conspire to render its conduct almost impossible. The sanitarian and school inspector must take every opportunity to educate the public to the fact that measles is a serious disease, that it is early infectious, that suspicious cases must be isolated without waiting for the eruption, and that the isolation must be thorough.

Quarantine.—For contacts, 18 days; for the sick, at least that length of time, and as much longer as for the entire completion of desquamation and the subsidence of the catarrhal conditions. After release from quarantine the child should not be allowed to re-enter school for at least 5 days longer.

Disinfection.—Many states do not require disinfection, but it seems to be excellent practice, although the measles germ is by no means tenacious of life.

RUBELLA.

Synonyms.—Rötheln; German Measles; French Measles; Epidemic Roseola; Rubeola notha.

Etiology.—This acute infectious disease is of unknown causation, spreads with great rapidity, frequently attacks adults, and previous attacks of scarlet fever or measles do not protect against it.

Symptoms.—The stage of incubation is supposed to be two weeks or more. The symptoms are much milder than those of measles in most epidemics; very rarely they may be severe.

In the stage of invasion there are chilliness, headache, pains in back and legs, and coryza. A rose red spotty eruption on the pharynx and fauces is a constant symptom. There may be slight fever, frequently not reaching over 100°, or absent altogether. This stage is variable in length, being placed by different authors at from 1 to 3 days. The eruption, which consists of round or oval slightly elevated spots, usually discrete but sometimes confluent,

appears first on the face, then on the chest and later over the whole body in the course of 24 hours. The rash is brighter colored than that of measles. The patches are less crescentic. The eruption lasts 2 or 3 days, sometimes longer, and gradually fades, and is followed by rather powdery desquamation. The lymph glands of the neck are enlarged quite constantly, and if the eruption is severe those of other parts of the body may be also.

Albuminuria, nephritis, jaundice, colitis and pneumonia are occasional sequelæ of this disease, but not with sufficient frequency to determine whether they are causally related or not.

Prophylaxis.—Not usually taken notice of by sanitarians as it is ordinarily a trivial disease. In severe epidemics it would be best to treat the cases as though they were scarlet fever.

FILATOW-DUKES' DISEASE.

Synonym.—Fourth Disease.

By certain writers it is claimed that two different diseases have been confused under the name *rubella.* In this second form the body is covered in a few hours with a diffuse eruption of a bright red color, almost like that of scarlet fever. The face may remain free. It is chiefly of interest owing to the possibility of confusion with scarlet fever. The symptoms are otherwise trifling.

CHAPTER VIII.

THE DIPHTHERIA GROUP.

This is a small but very important group, whose members have in common a great susceptibility to transmission by droplet infection and not very great liability to transmission by other means. Carriers of influenza, whooping cough and diphtheria are common, and may be suspected for mumps. Pneumonia also belongs to this class but is omitted for the reason that in the present state of our knowledge concerning this disease it cannot be said what measures possible to the sanitarian will ever be able to control it. All the diseases in this group are primarily found in the respiratory tract or its adnexa. In addition, diphtheria may infect the conjunctiva or genitalia.

DIPHTHERIA.

Synonym.—Membraneous Croup.

Definition.—A specific infectious disease, characterized by a local fibrinous exudate, usually upon a mucous membrane, and by constitutional disturbance due to toxins produced at the site of the lesion (Osler). The presence of the Klebs-Löffler bacillus is a necessary factor in true diphtheria, and it may be present without any of the ordinary symptoms of diphtheria. On the other hand, a precisely similar exudate may be present without the bacillus above named. (Vincent's angina, page 107.)

Habitat.—World wide. Endemic in large centers of population, becoming epidemic frequently, and pandemic in cycles.

Etiology.—Favored by dry seasons, and more prevalent in autumn.

Modes of Infection.—The disease is highly contagious, being particularly fatal to physicians and nurses; it may be conveyed by infected articles; it is also frequently traced to "carriers," in whom it is the cause of persistent suppuration of the ear or nasal sinuses, or tonsillitis, or may cause no discoverable symptoms, being recovered from the nasal or throat secretions of apparently healthy indi-

viduals. These carriers may or may not have had a preceding attack of frank diphtheria. Pencils, cups or other articles contaminated with the secretions of such persons have frequently carried the disease. Milk is also an excellent vehicle for the infection, and occasionally dust or domestic animals have been held responsible, though perhaps less rarely than should be the case.

Air-borne infections from defective drains, sewer gas, etc., are not believed to occur. The disease may also be conveyed by direct inoculation.

Predisposing Causes.—Diphtheria occurs at all ages, but is most frequent proportionately between the early part of the second and close of the fifth years, and is most fatal at those ages. It rarely occurs in infancy, but may be seen in the new-born, and may be seen at all ages to the other extreme of life. Girls are attacked slightly more frequently than boys. Individual susceptibility varies. Most of those exposed are attacked, but some escape even of those in whose throats or noses virulent bacilli are found.

The Klebs-Löffler Bacillus.—This bacillus is non-motile, from 2.5 to 3 mi. in length and from 0.5 to 0.8 mi. in thickness. Its recognition and special characteristics will be dealt with in the special chapter on *Laboratory Methods* (page 343). It varies greatly in virulence, even to complete harmlessness. Its noxious action is due to one or several toxins, which act on the heart muscle, causing fatty degeneration; on the kidneys, causing nephritis; on the nervous system, causing paralysis.

Pathology.—The false membrane in fatal cases is distributed in the order of frequency as follows: larynx, trachea, tonsils, epiglottis, pharynx, nose, uvula, esophagus, tongue, stomach, duodenum, vagina, vulva, conjunctiva.

In non-fatal cases, it is much more frequently found in the pharynx and upon the tonsils. It may be found on the skin surface occasionally.

This membrane is a dirty gray or greenish gray, firmly attached in the earlier stages, only to be removed by the use of considerable force and leaving a bleeding surface if detached. Later, it is soft, shreddy, and easily removed. If there has been much necrosis, the parts look gangrenous. The lymphatic glands of the neck are enlarged especially in fatal cases, and the salivary glands may be swollen. Sometimes the diphtheritic deposit is not a membrane,

but a dirty friable exudate. In either case it is composed of the bacteria, fibrin, and cast-off epithelium, and the primary condition is a necrosis of the superficial tissues of the throat or other part attacked, due to the toxins of the bacilli there growing. The bacilli grow only in dead tissue, spreading as fresh tissues are attacked and killed by the toxins.

The changes in other organs are as follows:

Heart.—The heart is frequently attacked by fatty or hyaline degeneration, and the heart muscle may be acutely inflamed.

Lungs.—The lungs are often the seat of a broncho-pneumonia, in which the diphtheria bacillus may be associated with the pneumococcus or streptococcus.

Kidneys.—These organs are often attacked by an acute inflammatory process, varying from a simple degeneration to the most intense nephritis.

Incubation.—2 to 7 days, oftenest two.

Onset.—The initial symptoms are those of an ordinary febrile attack, slight chilliness, fever, and pain in back and limbs. In mild cases the child does not feel ill enough to want to go to bed. The temperature in the first 24 hours usually reaches 102.5° or 103° and in severe cases to 104°. As in other acute febrile conditions, young children may have convulsions at the onset.

Symptoms.—PHARYNGEAL DIPHTHERIA.—In a typical case there is at first a slight redness of the throat with difficulty in swallowing. The membrane first occurs on the tonsils and may be hard to distinguish at first from the exudate of the tonsillar follicles. The tonsils are swollen. By the third day the whole throat including tonsils, pillars of the fauces and pharynx is covered with the membrane. This membrane is at first grayish-white, but later becomes a dirty gray or greenish or yellowish-white. If removed, the base bleeds and is soon covered again by the membrane. The glands in the neck are swollen and tender; the temperature is in uncomplicated cases about as recorded above; the pulse is from 110° to 120°. The local condition in the throat is not decidedly severe and constitutional symptoms are slight. The symptoms gradually abate, the swelling of the glands diminishes, the membrane separates, and from the seventh to the tenth day the throat clears up and convalescence is established.

Atypical Forms.—Atypical forms of pharyngeal diphtheria fall into the following classes (Koplik):

(a) No membrane, but a simple croupy cough.

(b) A pulpy exudate on tonsils, but no membrane.

(c) A punctate membrane, with spots isolated, on tonsils.

(d) Cases which are apparently follicular tonsillitis, at least in the beginning, but later there may be a true membrane, spreading to other parts of the throat or to the nose.

(e) "Latent diphtheria" (Heubner) secondary to rickets or tuberculosis, with fever, naso-pharyngeal catarrh and digestive disturbances or diarrhea. The true cause is frequently not discovered until autopsy.

Systematic Infection.—As a rule the constitutional disturbances bear a direct relation to the local severity of the disease, but this rule may vary in either direction. In the grave septic conditions sometimes seen, there is a general infection comparable to true septicemia. They usually occur at the height of the pharyngeal infection, and are accompanied by great swelling of the lymphatics, great prostration, and often by severe sloughing of the diphtheritic areas. The pulse is rapid and feeble, and the temperature may be only slightly elevated or subnormal.

Nasal Diphtheria.—In cases of this kind, the Klebs-Löffler bacillus is found in the nose, with or without a membrane. It may produce a most malignant form of the disease, or it may cause *Membranous* or *Fibrinous Rhinitis* in which the nose is blocked with thick membranes but there is little or no constitutional disturbance. This disease is benign and almost free of infectious features.

Laryngeal Diphtheria.—This form of the disease is usually due to the Klebs-Löffler organism, but may be streptococcic in origin. That due to the streptococcus is more apt to be secondary to other diseases.

The symptoms due to obstruction of breathing overshadow other features. The disease begins like an acute laryngitis, but after a day or two the child becomes worse, usually at night, and the respiration becomes obstructed. The obstruction is paroxysmal at first, but soon becomes continuous, and the accessory muscles of respiration are called upon, the chest moves convulsively, with retraction of the epigastrium and lower intercostal spaces are retracted with the fight for air, and the voice sinks to a whisper. The color becomes livid from imperfect oxidation of the blood, and the child tosses vainly in the effort to breathe. In favorable cases, the membrane is loosened and coughed up, but in unfavorable cases the

symptoms grow worse, the child becomes semi-comatose, and death is caused by suffocation.

Inspection of the throat may show a membrane in the pharynx or on the fauces, but a bacteriological examination is required to determine the offending cause.

Diagnosis.—The true diagnosis can only be made in any form of diphtheria by the use of cultures and the microscope, for which see the chapter on *Laboratory Methods* (page 343).

The two diseases with which diphtheria is most apt to be confounded are *Streptococcic Diphtheritis* which is due to infection by the streptococcus, and *Vincent's Angina,* an ulcerative condition of the throat, with a greenish-yellow exudate. Constitutional disturbances may be severe in either form, but the death-rate is not so high in these last two diseases. The recovery of the streptococcus in pure or nearly pure culture from the first, and of the *Bacillus fusiformis* from the latter will settle the question. It should not be forgotten that mixed infections of the Klebs-Löffler bacillus with other forms are sometimes seen.

Complications.—Albuminuria has already been mentioned as present in all severe cases. Nephritis may occur of all grades, sometimes ushered in by complete suppression of the urine.

Paralysis is the most common complication, occurring in from 10 to 20 per cent of all cases. It is due to toxin absorption and is capable of experimental production in animals. It may attack almost any of the muscles, but is more frequently observed in the palate, the muscles of deglutition and the eye muscles. It usually disappears in two or three weeks, but is a grave complication since the death-rate is considerably higher in paralyzed patients. The tendency to paralysis is lowered by the use of antitoxin.

Heart irregularities are present in a majority of all severe cases, as evidenced by the presence of a murmur. Cases of very low pulse rate (30 to 40) are very serious. Death may ensue from paralysis of the vagus, or from granular or fatty degeneration of the heart muscle.

The urticarial eruption ("nettle rash") caused sometimes by the use of antitoxin, and which is an effect of the proteids of the horse serum, resembles measles, and may be accompanied by pains and slight swelling of the joints. It comes on 8 or 10 days after the use of the serum, and lasts for 3 or 4 days.

A more serious condition is that of anaphylaxis or supersensi-

tiveness to the horse serum, which is sometimes fatal within a few minutes. It is due to a previous *small* injection of the serum or to a special intolerance to horse serum. It is so rare that its occurrence is not to be permitted to weigh against the use of antitoxin for a moment.

Antitoxin.—This serum is prepared by repeatedly injecting healthy young horses with dead cultures of diphtheria bacilli. It has wonderfully reduced the mortality if used early and used upon any case not actually dying will prove of great assistance. It has been used in a dosage of many thousands of units in severe cases, and the aim should always be to use enough. In a dosage of 500 to 1,000 units it is used for the immunization of contacts.

Prognosis.—In the pre-antitoxin days the mortality from true diphtheria ran as high as 40 to 50 per cent. In the same hospitals since the introduction of antitoxin it has never been over 15 per cent and most of the time from 10 to 12 per cent. By early diagnosis and the abundant use of antitoxin these figures may be still further improved.

Individual Prophylaxis.—The individual is best protected against diphtheria by care of the throat and teeth at all times. During epidemics the use of a spray of corrosive sublimate, 1 to 10,000, or chlorine water, 1 to 1,000, or Dobell's solution of phenol may somewhat aid. As already mentioned, the prophylactic use of the antitoxic serum is to be recommended, especially for contacts and for physicians and nurses.

Community Prophylaxis.—Prompt isolation of sick and of suspects until bacteriological examination has shown that the disease is not diphtheria. Diphtheria is particularly well adapted to treatment in contagious disease hospitals. No one should be released from the quarantine, even if not apparently sick, until cultures taken from the throat are shown to be negative. The dead must be cared for as in the special chapter on the subject. The tendency of the bacilli to persist in throat and nose long periods of time after convalescence is established should not be forgotten. All children and to a lesser degree adults who have been in contact with the disease should have swabs made and cultures taken, and if positive results are obtained, must be isolated until negative results are obtained, preferably on two successive days.

Quarantine.—Of the modified type. The length of time is determined by the results of cultures made.

Disinfection.—By fumigation with formaldehyd or sulphur, the former being preferable. Exposure for at least six hours under standard conditions is necessary for certain results.

Diphtheroid Diseases.—Isolation and disinfection in Streptococcic Diphtheritis and Vincent's Angina are not usually considered necessary in private practice after establishment of the diagnosis, but such cases must be excluded from school, and in institutions are best isolated and their quarters disinfected.

INFLUENZA.

Synonym.—La Grippe.

Definition.—A pandemic disease, appearing at irregular intervals, characterized by rapid spread and a high percentage of incidence wherever it occurs. It has many aspects, but shows a special tendency to attack the respiratory tract. For several years after a pandemic it remains as an endemic, epidemic or sporadic disease.

History.—During the Nineteenth Century there were four pandemics, reaching practically every part of the world. All of them appeared to start in the Far East.

Etiology.—It is a highly infectious disease, attacking usually about 40 per cent of the population. It is caused by a small nonmotile bacillus, which stains with methylene blue (Löffler's) and dilute carbol-fuchsin in water, the *Bacillus influenzæ.* This organism grows in pure culture only in the presence of hemoglobin, but in mixed cultures, for instance with the yellow staphylococcus, flourishes luxuriantly. It is not known to attack domestic animals. It is present in immense numbers in the nasal and bronchial secretion of patients, and in the latter may be in pure culture.

Catarrhal Fever (Grippe) is a rather similar disease which is of unknown etiology, and is endemic in American cities.

Incubation.—1 to 4 days, ordinarily 3 or 4.

Types.—Respiratory.—In this form the mucous membrane of the respiratory tract is attacked. There are coryza, bronchitis, cough, and the ordinary symptoms of catarrhal fever but with greater pain in back, limbs and head, and much greater prostration. The bronchitis is often severe, there may be pleurisy, or broncho-pneumonia may supervene. This pneumonia may be the result of the infection by the influenza bacillus alone, or it may be a mixed infection. Empyema is not an uncommon sequela of an influenzal pleurisy.

Nervous.—The back and headache and joint pains mentioned in connection with the first form are more intense, but the catarrhal symptoms are wanting. Abscess of the brain, meningitis or myelitis occur sometimes as results of this form of the infection. The bacillus has been found in the fluid withdrawn by lumbar puncture. Psychic symptoms, sometimes amounting to insanity are important sequelæ.

Gastrointestinal.—The onset of the fever is with nausea and vomiting, or with abdominal pain, profuse diarrhea and collapse. There may be jaundice, enlargement of the spleen or both. This form has not been common in the United States although appendicitis is supposed to be more common after grippe epidemics.

Febrile.—It is important to recognize the fact that the fever may be the only symptom of the disease. It may simulate either malaria or typhoid, and blood examinations may be necessary to clear up the diagnosis.

Complications.—There may be pericarditis, which is apt to be latent, endocarditis, or myocarditis. Functional heart troubles as palpitation, disturbances of rhythm, cardiac pain and the like are common. Phlebitis and thrombosis of various vessels have been observed.

Septicemia may be demonstrated by the cultivation of the bacillus from the circulating blood. *Peritonitis* is rare, and so also is *gall-stone* formation, though both have been observed.

Acute middle ear disease is perhaps the most common complication and has as its sequelæ *inflammation of the labyrinth* with its annoying dizziness and *mastoiditis* with its danger to life.

Diagnosis.—During an epidemic or pandemic this offers no special difficulty. In sporadic cases of the respiratory type, the sputum should be examined, and in other types the blood cultivated for the bacillus. The striking feature which differentiates influenza from all else is the prostration which is so out of proportion to the intensity of the disease.

Prophylaxis.—The sick should be isolated whenever practicable, and the aged and feeble should be kept so far as possible from possible sources of infection. This is made difficult, however, by the frequency with which "carriers" are found. Should the disease gain entrance into institutions, the sick and suspects should be isolated as soon as the first symptoms are seen.

The bodily discharges, especially the sputum, should be disin-

feeted with a standard disinfeetant. Fumigation is probably not called for, sinee the discase is disseminated almost wholly or eompletcly by earriers.

The rapidity of spread of epidcmies, in whieh almost cvery susceptible person in the community will be attaeked within 6 or 8 weeks, makes influenza a hard disease to combat.

Mortality.—Military experienee, which deals entircly with selected lives, shows a mortality of about 0.1 per cent while eivil statistics give a mortality of 0.5 pcr ecnt. With the heavy ineidence of the disease, this rolls up a formidable mortality. In 1904, in the registration area of the United States typhoid fever showed a mortality of 2,210, while for the same time and arca influenza caused 2,752 deaths. Of thcse 2,752 deaths, 1,755 were 65 years of age and over, showing the great influence of advanced years on the danger from the disease.

Immunity.—Some people are naturally immune to influenza, but an attaek does not usually confcr immunity, though perhaps this sometimes oeeurs.

WHOOPING COUGH.

Definition.—A specific affection characterized by eatarrh of the respiratory passages and a serics of convulsive coughs which end in a long-drawn inspiration or "whoop." (Oslcr.)

Etiology.—Sporadic cascs appear from time to time in the community, beeoming epidemic at intervals. It is probably almost always conveyed by droplet infection, though it is said to be earried at times by fomites. The epidemics appear usually during the winter and last into the spring, a period of 2 or 3 months, and frequently preeede or follow those of searlet fever or measles. It is highly infectious, few escaping an attack at some time during life; it affects by preferenee ehildren during the period betwcen the first and seeond dentitions, and girls somewhat more frequently than boys. Oftcn severc in adults. The morbifie agent is supposed to be a small baeillus with rounded ends whieh oeeurs in elumps in the sputum.

Pathology.—No special pathology is found in this discasc, but in fatal cascs the picture is that of broncho-pneumonia.

Immunity.—One attaek usually protects.

Incubation.—7 to 10 days.

Symptoms.—Catarrhal Stage.—The symptoms are those of an

ordinary cold with slight fever, running at the nose, injection of the eyes and a bronchial cough, generally dry, and perhaps somewhat spasmodic.

Paroxysmal Stage.—This dates from the first "whoop." The paroxysm begins with a succession of short expiratory coughs, 15 or 20 in number, compressing the chest laterally and bulging the sternum. The child becomes blue in the face, and a violent inspiratory effort succeeds, with the characteristic whoop, which is recognized instantly even by the laity. Several coughing fits may follow in rapid succession, with ejection of bronchial mucus and often vomiting. The vomiting may occur so frequently that the child cannot retain sufficient nourishment and becomes greatly emaciated. These attacks may only be 4 or 5 in the day, or in severe and fatal cases they may number 100. Involuntary urination or defecation may occur. Close dusty atmospheres excite the paroxysms, while clean fresh air mitigates them.

The course of the disease is from 6 weeks on in cases of ordinary severity, gradually declining in intensity toward the end.

Complications.—These are largely due to the terrific strain thrown on the circulation during the preliminary coughing. Hemorrhages may occur into the skin, conjunctiva, brain or abdominal organs. Death may occur from spasm of the glottis.

There may be emphysema or rupture of the lung, or bronchitis or pneumonia. Serious damage to the heart-valves may occur. Asthma may follow and persist through life.

Prognosis.—Whooping cough is a far more serious disease than is generally appreciated. In 1903 there were 9,522 deaths in England and Wales from this disease, 97 per cent being under 5 years of age. In the registration area of the United States for the years 1900-1904, the total number of deaths was 17,978, of whom 8,083 were males and 9,895 were females. 95.5 per cent occurred under 5 years and more than half under 1 year. The average annual death-rate was 11.3 per 100,000. This is much lower than that of European countries, the rate in Scotland reaching 62 per 100,000 in 1901.

It is very slightly less than the death-rate for scarlet fever in the registration area for the same time (11.8) but almost four times that of smallpox (3.7).

Prophylaxis.—Children and non-immune adults should avoid public gatherings during epidemics of whooping cough. Coughing

children, whether whooping or not, should be excluded from school and Sunday school. Affected children should be quarantined for at least 5 weeks from the beginning of the disease and until the whoop has entirely ceased. Immune children and adults need not be quarantined. Isolation has little value after the disease is well started in the community, but if the early cases can be properly handled, the epidemic may sometimes be stopped.

Disinfection.—Not generally required, but formaldehyd fumigation will do no harm, particularly in the earlier cases.

EPIDEMIC PAROTITIS.

Synonym.—Mumps.

Definition.—A specific infectious disease, whose cause is unknown, which attacks the salivary glands, and may be complicated by other glandular inflammations, particularly of the testes.

Etiology.—Endemic in large cities, becoming epidemic under circumstances not well understood, so that the incidence of the disease in different districts of the same city is very unequal.

Males are rather more frequently attacked than females, and the disease is one of childhood and adolescence, rarely attacking infants or adults. It is contagious and spreads from patient to patient, probably by droplet infection.

Incubation.—2 to 3 weeks.

Symptoms.—The invasion is marked by fever, usually about 101° but in severe cases going to 104°. Pain on one side, just below the ear is complained of, and a slight swelling is noticed which increases gradually for 48 hours until there is present great swelling of the cheek and side of the neck. The swelling passes forward in front of the ear, lifting the lobe, and back behind the sterno-mastoid muscle. Both glands may be involved in turn, and the submaxillary, sublingual and lachrymal may take part in the process. The pain is seldom severe but there is an unpleasant feeling of tension in the swollen glands.

The swelling of the salivary glands interferes with swallowing to a considerable extent.

There may be earache, sometimes otitis media, and slight impairment of hearing.

Rarely there is delirium, with high fever and prostration, passing even into a typhoid state.

The swelling in ordinary cases subsides in from 7 to 10 days, the

child recovers health and strength, and is none the worse for the attack.

Complications.—The most severe is orchitis, which rarely attacks boys before puberty. It comes on usually at the eighth day if the boy is not kept in bed. One or both testicles may be involved. Rarely the orchitis precedes the parotitis. In some cases the development of the testicle is checked or atrophy ensues, but even when both are involved, sexual vigor may be retained, though the procreative power is lost. There may be a urethritis also. In females, the breasts are attacked, there may be a vulvo-vaginitis, and rarely the ovaries are involved, but all these are less common than the orchitis of the other sex.

The disease is very rarely fatal.

Prophylaxis.—Children having mumps should be excluded from school, and in institutions all persons attacked should be promptly isolated. The disease is not notifiable or quarantinable and but little attention is given to its prevention outside military and institutional work.

CHAPTER IX

THE PLAGUE GROUP.

Diseases of this group are properly diseases of the lower animals, which are accidentally communicated to man. This may be by an intermediate host as in plague, by direct inoculation as in hydrophobia, by ingestion of infected material as in Malta fever or by infected animals or their skins as in glanders and anthrax.

Such a classification is not altogether satisfactory, but is convenient as bringing together a family of infections which does not well fit in elsewhere and also as emphasizing the fact that man must exercise supervision over his animal neighbors if he expects to remain free from their diseases.

PLAGUE.

Synonyms.—Bubonic Plague; Oriental Plague; Black Death; Black Plague; Pestis Hominis.

Definition.—The Plague is a febrile infectious disease, characterized by a tendency to buboes or carbuncles, in addition to the usual phenomena of the typhoid state (Tyson).

Habitat.—Bubonic plague is properly a disease of the Orient, whence it has spread at irregular and long intervals in epidemics and pandemics. It is at present apparently endemic in India and China, having resisted for 15 years strenuous efforts on the part of the Indian authorities to eradicate it.

Etiology.—Plague is a disease primarily of the Siberian marmot, or *tarbagan,* an animal allied to our prairie dog and woodchuck. This animal is the only one now known to have the disease in chronic form, all other animals either perishing promptly or recovering in a comparatively short time. This marmot furnishes a carrier which is capable of maintaining a supply of the germ for an indefinite time. Plague is also a disease of other rodents as the rats and squirrels. On this account all antiplague measures have as their foundation the destruction of rodents. For this reason the United States Government and the State of California have spent much

time and money in the destruction of ground-squirrels around San Francisco Bay and in other localities. There is reason to believe that if the disease should spread among the rats and gophers of the Sierras, it might in time reach the territory inhabited by the prairie dog and there become endemic, as it is among the *tarbagans* of Manchuria and eastern Siberia.

Bacteriology.—The bacillus of plague (B. pestis) is a short rod with rounded ends, resembling the bacillus of chicken cholera. It is found in the blood and glands and can be cultivated with little difficulty. It obtains entrance to the body by the respiratory and digestive tracts, but particularly through the bite of the rat-flea, which has left the body of the dead or dying rat and takes refuge wherever it can. The bacillus is also found in virulent form in the dust of infected houses, in this resembling anthrax and tetanus.

Pathology.—There is no special morbid anatomy to the disease, beyond the buboes and internal suppurations, subcutaneous and other hemorrhages, and the general picture of the effects of high fever. The liver and kidneys are congested and the spleen enlarged to several times its normal size.

Varieties.—There are four distinct types of this infection: *pestis minor,* the abortive or larval form, which is the usual precursor of epidemics, and is the form which is endemic in certain localities. There is little fever, the lymphatics are little swollen, there is not much constitutional disturbance, and the disease usually terminates favorably in about 2 weeks; the *bubonic* form, which is the more common severe epidemic type, in which there is great lymphatic enlargement and which constitutes about 70 per cent of all cases of plague; the *septicemic* type, sometimes called *toxic, siderant* or *fulminant,* in which death takes place too soon for any marked anatomical changes to develop, often within 24 hours; the *pneumonic* form, in which the force of the disease is spent on the lungs and the sputum is charged with the bacilli.

Incubation.—2 to 7 days.

Symptoms.—Bubonic or Ordinary Type.—After the period of incubation, the first symptom is ordinarily a most intense weakness. This may be followed by headache, nausea, vomiting, vertigo and rarely lumbar pain. There is usually no chill but a feeling of chilliness may be present. The fever sets in rapidly, going up at once to 102° to 104° or higher. The pulse is from 90 to 120, often dicrotic. Petechiæ and vibices are seen, and hemorrhages

from the kidneys and stomach are not uncommon. Albuminuria is the rule. The spleen is slightly enlarged. On the second or third day, if the patient has not succumbed, the *buboes* appear in any or all of the regions having lymphatic nodes close to the surface. These buboes come up rapidly, and on reaching the size of an egg or a little less, rupture unless sooner opened, as a rule. More rarely they undergo resolution without suppuration. The buboes are tender and painful, but the occurrence of suppuration is a favorable sign. Coincident with it, a profuse sweat comes out and the temperature drops, the pulse also subsiding. Carbuncles on any part of the body are a distressing concomitant of this form of the disease.

PNEUMONIC TYPE.—Here are seen the usual symptoms of a pneumonia, but instead of the pneumococcus, the plague bacillus is found in the sputum.

SEPTICEMIC TYPE.—In this form the toxins overwhelm the body too rapidly for reaction to take place, hence the symptoms are few. There is the most intense prostration, sometimes without fever. The lymphatics and spleen are enlarged everywhere, but only to a small degree. Hemorrhages from nose, bowel, or kidneys are very characteristic of this form. There is typhoid delirium.

Diagnosis.—This disease is not likely to be mistaken for anything except typhus, and is differentiated from that by the very great pain accompanying the latter disease. The isolation of the *Bacillus pestis* from sputum, blood or pus will settle the diagnosis. An epizoötic in which rats are found dead in the streets will at once put the sanitarian on his guard against plague.

Prognosis.—Plague is the most fatal of epidemic diseases, from 70 to 90 per cent perishing.

Individual Prophylaxis.—By vaccination with the dead bacilli, after Haffkine's method, which is comparable to the other bacterial inoculations. A mask should be worn when near pneumonic cases to prevent droplet infection. Suppurating cases and in fact all others should be handled with rubber gloves to prevent direct skin inoculation through abrasions.

SERA.—Lustig and Yersin have prepared curative sera by somewhat different methods, which are comparable to the diphtheria antitoxin. In case persons have been exposed to the plague, a dose of one of these sera should be administered before the Haffkine vaccine is administered, in order to prevent the development of a

possible phase of increased susceptibility which is sometimes known to occur.

Community Prophylaxis.—As before stated, this depends on the prompt and complete destruction of rats, and their barring out from gaining re-entrance to buildings of all kinds. These methods are completely covered in Chapter XXVIII, page 265. The health officer who suspects that plague has made an appearance among the rats in his territory should at once communicate with his State Board, who will send a laboratory worker to aid in making a diagnosis. If this is confirmed, at the request of the State Board the Public Health and Marine Hospital Service will at once send experts to take charge of the situation who will be provided with antipest serum and vaccines, which are not usually obtainable commercially. Unless the disease is diagnosed from rats, there will probably be a number of human cases of *pestis minor* and the disease fairly well established before the occurrence of a bubonic case gives the clue to the diagnosis. Plague should be taken care of in special isolation hospitals (see Chapter IV).

Quarantine.—The Regulations of the Public Health and Marine Hospital Service specify 7 days as the period of quarantine for contacts. For pneumonic or bubonic cases recovering the British regulations require 1 month's isolation. If the plague bacilli are still recoverable from any secretion, the patient should not be discharged, and if repeated examination shows him free he may be safely discharged without regard to time.

Disinfection.—This consists of two parts: Disinfection against the bacilli, which is necessary since it has been shown that they are able to live even in the dry state for a period of 4 months if the place is dark and the temperature does not rise above 68°, and disinfection aimed against the flea and his rodent host. Formaldehyd is efficient against the former, but does not kill the latter two. Sulphur used according to the directions on page 58 kills all three. If formaldehyd is used it must be supplemented by hydrocyanic acid, camphor (see page 59), or the oxides of carbon. Either sulphur or the formaldehyd-hydrocyanic acid combination is well followed by bichloride, cresol or carbolic spray, since all fomites may not have been reached by the fumigation, and in the presence of albuminous material the bacillus may continue virulent for a long time.

MALTA FEVER.

Synonyms.—Mediterranean Fever; Neapolitan Fever; Rock Fever; Undulant Fever.

Definition.—An irregular fever, characterized by alternate remissions and relapses, sweats and rheumatoid pains, caused by the *Micrococcus melitensis*.

Distribution.—Mediterranean Countries; Eastern Asia; sporadic in West Indies; Mexico and Texas.

Etiology.—It is primarily a disease of goats, and is conveyed by the milk of the animal, and possibly by biting insects. The organism is found in large numbers in the spleen, but not as yet in the general circulation. In the human race the method of infection from person to person and the degree of infectiousness are not yet settled.

Pathology.—The gross lesions are those of typhoid.

Predisposing Factor.—Youth.

Incubation.—6 to 10 days.

Symptoms.—Onset gradual; headache, sleeplessness, thirst; loss of appetite, no chilliness or high fever at first.

No diarrhea or rose spots. These symptoms continue for 3 to 4 weeks, with a following remission, simulating convalescence. After a few days of remission the second attack occurs, with rigors, high fever and frequently diarrhea. This relapse continues for 5 or 6 weeks, followed by a second remission of 10 to 14 days, and a second relapse which has the same symptoms as the preceding, with the addition of great debility, night sweats, pain in the joints and testicles, lasting 3 or 4 weeks. This is followed by a third remission lasting a month or 6 weeks.

There is then a third relapse, shorter in duration adding to the previous symptoms a heavily coated tongue, a normal morning temperature with high evening rise (105°) with very severe night sweats and rheumatic pains. Motion is difficult owing to pain in the joints.

Diagnosis.—Difficult on account of the rarity of the disease, but may be made by the reaction of the serum on suspensions of the *Micrococcus melitensis*.

Prognosis.—Favorable; about 2 per cent dying.

Prophylaxis.—Avoid milk of goats imported from Mediterranean countries or from the endemic center in Texas. The dust contain-

ing the droppings of these goats is infectious even after 19 days' drying, so that the vicinity of infected flocks must also be avoided.

If in summer keep patient under mosquito bar or in well-screened room.

Quarantine.—None.

Disinfection.—None.

ANTHRAX.

Synonyms.—Malignant Pustule; Contagious Carbuncle; Splenic Fever; Splenic Apoplexy; Gangrene of the Spleen; Carbuncle Fever; Blood-striking; Choking Quinzy; Bloody Murrain; Wool-sorters' Disease; Rag-sorters' Disease; Charbon (Fr.); Milzbrand (Ger.).

Definition.—An acute infectious disease of animals, particularly affecting cattle and sheep, but transmissible to man, caused by the implantation and multiplication of the *Bacillus anthracis* (Tyson).

Etiology.—The bacillus of anthrax is the largest of the pathogenic bacilli, being from 5 to 20 mi. in length, and 1 to 1.25 mi. in thickness. It is spore-bearing and aerobic, and can be isolated in enormous numbers from the tissues of infected animals. The spores may retain their vitality even under unfavorable conditions for long periods of time, even for years, their virulence remaining unaffected. Those most frequently affected are herdsmen, stable-hands, butchers, skinners of dead animals and wool-sorters.

Pathology.—The body after death is cyanotic, blood dark and stringy, coagulating slowly, and the spleen soft and enlarged. The gastrointestinal membrane is swollen and ecchymotic; gangrenous patches are seen, and blood escaping from the vessels appears here and there under the skin. Plugs of bacilli are found in the blood-vessels.

Incubation.—About 7 days.

Symptoms.—External Anthrax.

(1) *Malignant Pustule.*—This appears most frequently on exposed parts of the body as the face, hands and arms, wherever the inoculation has taken place. It begins with itching, which is intensified to a sharp burning pain, like the bite of an insect. Redness follows, developing rapidly into a papule, in the center of which a vesicle appears, filled with fluid which may be clear or cloudy. The vesicle bursts and the papule enlarges and becomes indurated. A number of daughter vesicles then form. The induration extends

and becomes brownish at the center which forms an eschar in about 36 hours; this soon sloughs and disintegrates, the vicinity of the pustule becomes edematous, the lymphatics take up the infection and become hard, swollen and painful. The general symptoms are those of a violent infection, with thirst, high temperature and rapid pulse. The liver enlarges and the spleen becomes large, dark and very friable.

Death ensues in almost all cases in from 2 to 5 days. Only in the mildest cases does the scab dry up and the symptoms subside.

(2) *Malignant Anthrax Edema.*—This begins in the eyelids and spreads to the head, face and arms. The skin is reddened, and vesicles and gangrene may appear, but there are no papules. The constitutional symptoms appear before the local, and this form of anthrax is even more deadly than the preceding.

INTERNAL ANTHRAX.—(1) *Intestinal Anthrax.*—The infection is by the alimentary tract; the early symptoms are chill, vomiting, bloody diarrhea, abdominal pain and tenderness. The conditions mentioned in a preceding paragraph are found in the gastrointestinal canal at autopsy. Pustules may form on the skin. It is invariably fatal.

(2) *Wool-sorters' Disease* (*Pulmonary Anthrax*).—This arises from the inhalation of the bacilli in dust arising from infected wool, hides, or rags. The symptoms are like those of the preceding form except that the intestinal symptoms are replaced by pulmonary symptoms, as cough and bronchitis, with the physical signs of pulmonary involvement. Premonitory symptoms are usually wanting and external lesions not discernible. It is rapidly fatal, usually in 24 hours. After death the capillaries of the lungs and brain may be found choked with bacilli. The prognosis is bad, but if the patient is able to survive one week he may ultimately recover.

Diagnosis.—In external anthrax this is easily done by staining a little of the fluid from a pustule and examining for the bacilli, which are very large and easily recognized. A mouse or guinea-pig may be inoculated and the bacilli recovered from the internal organs. Internal anthrax is apt to go unrecognized unless examination is made of feces or sputum in the appropriate type of infection, and inoculation experiments carried out. A symptom complex like the ones above noted in men whose occupation brings them into contact with herbivorous animals or with wool should arouse suspicion and suggest the use of the microscope.

Prophylaxis.—Animals dead of this disease should be cremated and no attempt made to utilize any part of the carcass. Wool and rags should be sterilized by super-heated steam and hides thrown into vats containing formaldehyd solution with at least 1 per cent of formaldehyd gas, and allowed to remain for 12 to 24 hours before removal.

Quarantine.—Absolute, till the death or recovery of the patient. Only nurse, physician and undertaker should be allowed to come in contact with the patient, and they should protect themselves most carefully by the use of rubber gloves, while physician and nurse should wear a face mask to protect against "droplet infection."

Disinfection.—With a double quantity of formaldehyd for 12 hours with proper moisture. Infection from one person to another is not common, simply because the disease is not common, and it must be borne in mind that this disease is one of three or four absolutely known to be transmissible by fomites.

Prevalence.—The largest number of deaths in the registration area reported in the last 10 years is 25 in 1904.

GLANDERS AND FARCY.

Synonym.—Malleus humidus.

Definition.—An infectious disease more particularly of the horse, but communicable to man and other mammalia. It is characterized by nodular growths in the nose (glanders) or under the skin (farcy).

Etiology.—This disease is due to infection with the *Bacillus mallei,* which is a short non-motile bacillus, not unlike that of tuberculosis and leprosy in shape, but shorter. It is most usually found in the characteristic lesions, but is also to be cultivated from the blood.

The disease is communicated through abrasions on the skin or by inoculation on the intact mucous membrane. This is an occupational disease of hostlers and others having to work with horses.

Pathology.—The characteristic lesions are the nodules and "buds" which vary from lentil- to first-size, and are composed of round cells invading the tissues, which tend to break down and form ulcers, often with underlying abscesses, especially under the skin. Any of the tissues of the body may be involved in the process.

Incubation.—3 to 5 days, rarely 1 week.

Symptoms.—ACUTE FORMS.—*Glanders.*—Redness and swelling of the nasal mucous membrane at the point of inoculation, with dryness and burning in surrounding portions of the nasal tract. Intense pain from frontal sinus involvement may be present. This is quickly followed by nodule-formation with rapid breaking-down of the same, and ulceration, with the discharge of foul-smelling pus. The process extends to the remainder of the nose, accessory sinuses, pharynx, larynx, and lungs, and to other organs. The submaxillary glands swell and suppurate. Painful swallowing, hoarseness, and cough are the symptoms dependent on these lesions.

Farcy.—The typical swellings appear in the skin, which become nodular and ulcerate, discharging a fetid blood-stained pus. Papules which become pustular may develop in the neighborhood. The eruption has been mistaken for smallpox in cases where the latter lesions predominate. "Farcy buds" form along the lymphatics, and are nodular enlargements under the skin. The nose is not involved.

The symptoms common to both the acute forms are chilliness, high temperature, intense prostration, pain and soreness in muscles and joints, abscess formation, the typhoid state, and death.

CHRONIC FORMS.—*Glanders.*—The symptoms are those of an incurable coryza or laryngitis. It is not easy to recognize.

Farcy.—The nodules break down, but the lymphatics are not involved, and the process is slow. Acute glanders or farcy may supervene on the chronic form. The constitutional symptoms are not so severe or are wanting in both chronic types.

Diagnosis.—By *mallein,* an aqueous extract of the *B. mallei,* which is used in the same manner as tuberculin, and by the agglutination test, the serum being diluted to 200 or more. The disease has exceptionally been mistaken for smallpox or pyemia, but the two tests above noted or the recognition of the bacilli in wound-secretions or cultures will differentiate from these conditions at once.

Glanders Pneumonia is sometimes seen, the lung appearing like an ordinary caseous pneumonia.

Albuminuria may be present and the liver and spleen enlarged in any form of the disease.

Prognosis.—Acute glanders is invariably fatal. Acute farcy is

usually fatal in from 12 to 15 days. About 50 per cent of the chronic cases recover.

Prophylaxis.—Animals suspected of having the disease should be handled with the utmost care, and as soon as a positive diagnosis is made should be killed and the bodies burned. It is communicable from man to man, and by fomites. Washerwomen have been infected by the soiled linen of persons sick with the disease.

Quarantine.—The quarantine and disinfection are as for anthrax.

Prevalence.—Not more than 8 deaths have occurred in the registration area in any one year of the last decade.

FOOT-AND-MOUTH DISEASE.

Definition.—An infectious disease of the lower animals, communicable to man. Cattle, sheep and hogs are most commonly infected, horses and goats less often, and fowls, dogs and cats still more rarely (Tyson).

It is characterized in these animals by fever, and the presence of vesicles and ulcers in the mucous membrane of the mouth, in the furrows and clefts about the feet, and about the teats of animals.

Etiology.—The specific organism is not known, though a streptococcus and a micrococcus have been described. The disease is chiefly communicated by the contents of the vesicles alluded to, but the urine, feces, saliva, as well as unboiled milk, butter and cheese may convey the contagion. The virus is filterable through a Pasteur-Chamberland porcelain filter.

Incubation.—3 to 5 days.

Symptoms.—Fever, malaise, loss of appetite; the vesicles appear in the mouth, chiefly on the lips and tongue, but sometimes on the pharynx and hard palate, and exude a yellowish serum; simultaneously or a trifle later they come out around the nails, between the fingers and toes, and more rarely around the nipples of women, or over the whole body, like smallpox.

Prognosis.—Favorable in all cases except very young children who sometimes die.

Prophylaxis.—Milk from herds suffering with this disease must be excluded from the market until the epizoötic is over. Boiled milk is safe. Simple measures of cleanliness are sufficient to prevent the infection of the human subject, who is relatively immune.

Quarantine and disinfection are not required, but are probably advisable.

HYDROPHOBIA.

Synonyms.—Rabies; Lyssa.

Definition.—Hydrophobia is an acute infectious disease, of variable but usually long period of incubation, characterized by tonic spasms, beginning in the larynx.

Etiology.—The disease is common to all warm-blooded animals, and is communicable only by inoculation, usually by biting. The dog is the animal most commonly affected and the agent by which the disease is most commonly communicated to man. The virus is contained in the saliva, and in all the nervous tissues. The poison reaches the saliva by way of the nerves and not through the blood vessels. Its intensity varies with the species of the biting animal; wolves, cats, dogs, and other animals forming in this order a descending scale of virulence. It varies further with the age of the patient, younger children not only being more frequently attacked, but more susceptible; with the location of the bite, wounds on the face and head or in parts richly supplied with nerves being more dangerous; with the extent of laceration, large wounds carrying more of the infecting virus and being more difficult to clean and cauterize thoroughly, the punctured wounds caused by the canine teeth of dogs and wolves being particularly grave. Only about 15 per cent of those bitten by dogs contract the disease, while wolf-bites give a mortality of 60 to 80 per cent.

Incubation.—The average period is from 6 weeks to 2 months, but in a few cases has been less than 2 weeks.

Pathology.—The essential feature of the pathology of hydrophobia is the presence in the central nervous system of irregular bodies called "Negri Bodies" from 4 to 10 mi. in size, which are probably protozoa, but as yet of unsettled classification.

Symptoms.—PREMONITORY STAGE.—There may be irritation or numbness about the bite; depression or melancholy; headache, irritability and loss of appetite. Bright lights or loud noises are distressing. The larynx is often congested and the voice husky, while the first symptoms of difficulty in swallowing soon appear. The temperature is slightly raised and the pulse accelerated.

STAGE OF EXCITEMENT.—This is characterized by great excitability, restlessness and extreme hyperesthesia, so that the slightest stimulus such as from a draught of air or a light touch is sufficient to bring on a convulsion. This is the most distressing feature of

the malady to witness. There are exceedingly painful spasms of the muscles of the larynx and mouth, accompanied by a frightful sense of dyspnea, even after tracheotomy. Any attempt to swallow brings on spasm of the muscles involved, a fact which has given the name *hydrophobia* to the disease. There may be maniacal symptoms. In the intervals the patient may be quiescent and rational. The temperature is from 100° to 103°. The patient rarely attempts to hurt anyone, and even in the most severe spasms may be most careful to avoid it. The spasmodic contractions of the laryngeal muscles may give rise to odd sounds like the voice of the lower animals, which has given origin to the superstition that hydrophobic patients bark like dogs. This stage lasts from 1 to 3 days and passes into the paralytic stage.

The Paralytic Stage.—The patient becomes quiet, the spasms no longer torment, the heart weakens, and death occurs by syncope in from 6 to 18 hours after the supervention of this stage.

Diagnosis.—The diagnosis usually offers no difficulty. The symptoms taken with the history of a bite by a dog or other animal some time before make the matter only too plain. The only diagnosis which is of value is to be made from the brain of the biting animal, or by observation of the living animal for at least 10 days. If at the end of this time it is in good health, hydrophobia is not to be feared. The methods for sending the brain to the laboratory are fully described in Part III, page 358.

Prophylaxis.—The prophylaxis of hydrophobia is to be obtained by the systematic, long-continued muzzling of all dogs. In American communities the comfort of the dog is usually rated higher than human life and the measure is applied only half-heartedly and is valueless. The only proper muzzle is one of wire, which allows the dog to open his mouth but prevents him from biting. Straps around the jaw do not prevent him from biting and make him very uncomfortable.

Bites of rabid animals are best cauterized with the actual cautery, with nitric acid or pure carbolic acid, followed by alcohol.

Preventive Inoculation which was originated by Pasteur, consists of intensifying the action of the virus by passing it through successive rabbits, until the period of incubation is reduced to 7 days. The spinal cords of these rabbits are preserved in dry air for 12 to 15 days, and a small quantity of the emulsion prepared by triturating the cord with physiological salt solution is injected

into the person to be immunized. This is followed by injections on the following days of emulsions made from cords which have been preserved for fewer and fewer days, the contained virus being stronger and stronger. This method has given the most gratifying results, and where it is undertaken promptly is rarely unsuccessful. This virus is now supplied by several biological product houses, so that the treatment is capable of administration by any well-qualified physician; several states also supply it or administer it free of charge to the poor.

Prognosis.—In developed cases, absolutely fatal.[1]

Prevalence.—The registration area of the United States shows for the period 1901-5 an average of 42 deaths from hydrophobia; 1903, 43; 1904, 38; 1905, 44; 1906, 85; 1907, 75; 1908, 82. In view of the frightful physical and mental suffering involved, and the certainty of death at the end, it would seem that no measures are too drastic to prevent the spread of this disease.

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[1] October, 1913. Treatment based on the supposed protozoal nature of the Negri bodies by large doses of quinine administered hypodermically is reported to have resulted successfully. In view of the hopeless prognosis it is worth trying. Any soluble salt of quinine may be used.

CHAPTER X

THE YELLOW FEVER GROUP.

The diseases of this group are alike in having a known or probable protozoön origin, having two cycles—an endocorporeal or human cycle, which is characterized by the asexual multiplication of the parasite, and an extracorporeal or sexual cycle within the body of some winged insect, which sexual cycle requires a period of some days before the insect becomes capable of reinfecting the human body.

Besides the diseases here mentioned, two others at least should be noted which are omitted for reasons of space: African sleeping sickness, which is a trypanosomiasis and is transmitted by the tsetse fly (Glossinia) in whose body it has an incubative period of 3 weeks, and filariasis, which is transmitted by the Culex mosquito.

This group has been separated from the Typhus Group, since the latter diseases are carried by wingless insects, and with one exception are not known to have an extracorporeal cycle. Both of these insect-borne groups of diseases may be expected to be augmented, especially in the tropics, with more exact knowledge.

YELLOW FEVER.

Definition.—Yellow fever is an acute infectious disease, characterized by a febrile paroxysm succeeded by a brief remission and a relapse. It is associated more or less constantly with jaundice, and tendency to hemorrhage especially into the stomach, whence the blood is vomited, constituting "black vomit." Neither jaundice nor black vomit is essential to the disease (Tyson).

Distribution.—Guiteras gives the following distribution: (1) The focal zone, including Havana, Vera Cruz, Rio de Janeiro, and other portions of the east coast of tropical America; previous to 1901 the disease was constantly present in all of the larger cities of this area; (2) The perifocal zone, or zone of periodic epidemics, including the ports on the Atlantic in tropical America and Africa; (3) The zone of accidental epidemics, between 45° north and 35°

south latitude. It is also found in the interior during accidental or periodic epidemics, but very rarely at a height greater than 1,000 feet above sea-level.

Etiology.—The specific morbific organism is supposed to be an ultramicroscopic protozoön, and is known to be transmitted in nature only by mosquitoes of the genus *Stegomyia* and usually by *S. fasciata.* Not all of the Stegomyine mosquitoes are known to be capable of transmitting this fever, but all should rest under suspicion. An interval of at least 12 days after the mosquito receives the infected blood is necessary before its bite becomes dangerous to a non-immune. Yellow fever is never conveyed by fomites or direct infection, except by experimental inoculation of the non-immune by sub-cutaneous injection of yellow fever blood.

Predisposition.—Yellow fever attacks all ages, races and nationalities, but negroes rather less frequently than whites. Males are more often infected than females, since their work renders them more likely to be bitten by mosquitoes.

Incubation.—In experimental cases the incubation period has varied from 41 to 137 hours.

Immunity.—One attack usually protects. There is no method of securing artificial immunity.

Pathology.—Intense jaundice and subcutaneous hemorrhages are generally present. The blood is partly "laked"; i. e., its hemoglobin is partially dissolved in the serum. The liver is brown, with a "coffee and cream" color, and is frequently fatty. The kidneys often present cloudy swelling or an actual nephritis. After death the stomach contains more or less extravasated blood, the mucous membrane is congested and swollen. Yellow fever cannot be diagnosed post-mortem unless the history of the case is known.

Symptoms.—Stage of Invasion. (Febrile Stage).—Onset sudden, generally with chill, followed by headache, pain in back, and aching of the limbs. It may begin at any time of day, but more frequently begins at night while the patient is relaxed. The fever rises quickly to a point between 102° and 105° and the pulse at first corresponds but on the second or third day begins to fall and may drop as many as 20 beats per minute even while the temperature rises. The skin is hot and dry, but not as much so as in typhus. As early as the first day the face is flushed, the eyes reddened, the lips slightly swollen, the tongue covered with a moist fur, the

throat sore, the bowels constipated, the urine scanty and often albuminous, though albuminuria is not regularly present till the third day.

Nausea may be present from the beginning, but black vomit is not seen until the second or third day. This is often compared to coffee, and the sediment to the grounds. In the worst cases it is tarry black. It consists of broken down red cells and pigment. The febrile stage lasts from a few hours to 3 days.

Stage of Calm.—The fever declines for a few hours or a day or two in severe cases, and in mild cases convalescence may date from this stage, but ordinarily it merges into the third stage or stage of febrile reaction.

Stage of Febrile Reaction.—This lasts from 1 to 3 days. The temperature again rises, although the *pulse may continue to fall.* The nausea and vomiting return, the latter becomes again hemorrhagic, and there may be pain in the abdomen. The feces are black and offensive. If jaundice has not been present, it now makes its appearance, the tongue becomes dry and brown, there may be bleeding from any or all mucous membranes. To albuminuria may be added hematuria. The strength fails, the pulse grows weaker, there are tremblings, suppression of the urine, delirium, convulsions or stupor and death.

The termination is not inevitably fatal, even when black vomit is seen. The symptoms may gradually subside and convalescence take place though the jaundice may remain for a long time.

Diagnosis.—The three characteristic symptoms are: early jaundice, early albuminuria, and the slowing of the pulse with stationary or rising temperature. During defervescence, the pulse may go as low as 30 beats per minute, while at the height of the fever, with a temperature of 104°, the pulse may be as low as 70 or 80.

Prognosis.—In various epidemics the mortality has varied between 15 and 85 per cent so that it is an exceedingly grave disease. It is greatest in the feeble, the dissipated and the poor.

Prevalence.—In the quinquennium from 1901 to 1905 there was an average mortality of 95 in the registration area of the United States, practically all of it concentrated in the one year 1905, when 438 deaths occurred. In 1907 and 1908 there were 1 and 2 deaths respectively, and in other years of the century none.

Prophylaxis.—(1) The non-immune must be guarded against the mosquito.

(2) The sick must be protected against the mosquito in a carefully screened room in order to prevent infection of the mosquito.

(3) Mosquitoes and their larvæ must be destroyed by the methods detailed in the special chapter on the subject, page 281.

These simple methods have eradicated yellow fever wherever they have been conscientiously applied, as in Havana and Panama, by the Medical Department of the United States Army. By their use such drastic measures as depopulation are not necessary. Heretofore the non-immunes have been sent to uninfected and uninhabited places to prevent the spread of certain epidemics.

Quarantine.—Quarantine for the sick is of no value unless the patient is isolated in a mosquito-proof room or apartment. For persons coming into the United States from infected ports a quarantine of 6 days is required, and the same period is necessary for contacts.

Disinfection.—No disinfection is of value which does not kill the mosquito. Sulphur or hydrocyanic acid may be used, or pyrethrum (ordinary insect powder) burned in the room. This last method merely stupefies the mosquitoes, which must be swept up and burned.

MALARIA.

Synonyms.—Ague; Fever and Ague; Chills and Fever; Marsh Fever; Swamp Fever; Paludal Fever; Miasmatic Fever; Intermittent, Remittent, and Pernicious Remittent Fever; Bilious Fever; Estivoautumnal Fever; Paludism.

Definition.—The malarial fevers are a group of fevers of intermittent or remittent type due to infection by the various species of *Plasmodium,* a parasitic protozoön, and which owe their peculiar characteristics of paroxysms or continued fever to the intermittent or continuous sporulation of the parasite. This disease is transmitted only by the mosquitoes of the genus *Anopheles,* and apparently not by all the species of this genus.

Distribution.—Malaria was formerly spread over the whole of Europe, but is now rare except in southern Russia and Italy. It is to be found in most parts of the United States, even in the arid portions, wherever the *Anopheles* has established itself and found human carriers of the parasite. It is universal in the parts of the tropics having much rainfall, except on certain islands where the mosquito has not yet reached. It is particularly deadly in certain

parts of Africa, in India, and was formerly so in Panama before the energetic antimosquito campaign at the beginning of the construction of the Canal.

Etiology.—The three known species of the *Plasmodium* are as follows:

Plasmodium Vivax.—The parasite of Tertian Fever. The earliest form found in the human blood is about 2 mi. in diameter, round or irregular in shape, without pigment. It corresponds to one segment of the rosettes hereafter to be described. A few hours later the parasite is larger but still retains the ring shape and contains fine pigment grains. There is a large nuclear body and opposite it a body of chromatin, which stains deeply with the proper stains. It is now actively ameboid and shows tongue-shaped protrusions of protoplasm. The parasite continues to grow until at the end of 48 hours it has grown beyond the normal dimensions of the red cell which forms its home. Between the fortieth and forty-eighth hours it may be seen undergoing segmentation, in which all the pigment is collected into a mass, while the plasmodium divides into from 15 to 20 spores, arranged radially and forming the *rosette.* Not all the plasmodia segment in this manner, but some become enlarged and retain their pigment, which is in active motion. These large parasites are the sexual form the *gametocytes,* and are destined only to perform their part in the transmission of the disease in case they are taken into the body of the *Anopheles* mosquito.

Plasmodium Malariæ.—The parasite of Quartan Fever. This somewhat resembles the tertian parasite, but the pigment granules are coarser and darker. By the second day the parasite is larger than the tertian, shows little ameboid motion, and the pigment is peripheral rather than diffused. The rim of protoplasm around the outside is deep yellowish-green or brassy in color. On the third day, sporulation begins, the segments being from 6 to 12, and some of the parasites persisting without segmentation to form the gametocytes.

Plasmodium Præcox.—The parasite of estivoautumnal fever. This is considerably smaller than the other two varieties; at full development it is often not more than one-half the size of a red cell. The pigment is much scantier, often forming only a few scant granules. The earlier stages of development present only small hyaline bodies, perhaps with a pigment granule or two, in the peripheral circulation. The later stages are to be found in the

spleen, bone marrow, and perhaps the brain. The corpuscles containing the parasites are often shrunken, brassy and crenated. After the process has gone on for about a week, larger, refractive, crescentic, ovoid and round bodies appear. These are the characteristic plasmodium forms of estivoautumnal fever, and are the gametocytes. In the blood they undergo no further development, but in the mosquito, the male gametocytes segment to form the *microgametes,* and the female to form the *macrogametes.* The microgametes penetrate the cell wall of the macrogametes and fecundate the female in this manner. The fecundated female parasite then penetrates the stomach wall of the mosquito and there undergoes a regular cycle of development which fits it to be reinoculated into the human species. Much of this process can be witnessed on the warm stage of the microscope.

In addition to these three known forms, there is reason to believe in a fourth, which is responsible for the dreaded blackwater or hematuric fever of the tropics and our own Southern States.

Pathology.—Simple malarial fevers are rarely fatal, and what we know of the disease is largely drawn from autopsies on victims of pernicious malaria or malarial cachexia.

Pernicious Malaria.—The blood is watery and the serum may contain free hemoglobin. The red cells are heavily infected with the parasite and are to be found in all stages of destruction. The spleen is enlarged, often only moderately. In a fresh infection, the spleen is pulpy and soft and often laked by free hemoglobin. When choleraic symptoms are present, the gastrointestinal capillaries may be found choked with the parasites.

Malarial Cachexia.—Death usually results from anemia or hemorrhage, the anemia being particularly profound if the patient has died of fever. The spleen is greatly enlarged, sometimes weighing 7 to 10 lbs. The liver is greatly enlarged and slaty-gray in color. Melanin is present around the portal canals and under the capsule. The kidneys, peritoneum, and mucous membrane of the stomach and intestines may also be stained with melanin, which is a decomposition product of hemoglobin.

Malarial hepatitis, pneumonia and nephritis are accidental rather than regular accompaniments of the disease, although Osler states that in his cases of estivoautumnal fever, nephritis was present in 4.5 per cent and albuminuria of moderate amount in 46.4 per cent of the same class of cases.

Clinical Course.—TERTIAN AND QUARTAN INTERMITTENTS.—The incubation period as determined experimentally is from 36 hours to 15 days.

PRODROMES.—The patient knows a few hours before that he will have a chill, on account of a peculiar feeling of uneasiness, with lassitude and often with headache.

COLD STAGE.—The lassitude increases, the patient yawns and stretches, and the thermometer in mouth or rectum indicates a slight rise in temperature. The patient begins to shiver, the body becomes blue and cold, and the surface temperature is reduced, although the rectal temperature at the same time is 105° or 106°. There may be nausea, vomiting and intense headache. The pulse is quick, small and hard. This continues for a few minutes to an hour or longer, and passes over into the hot stage.

HOT STAGE.—This is ushered in by a few hot flashes, the surface gradually becomes flushed, hot and dry; the pulse is full and bounding, and the heart's action is forcible. There may be pain over the liver and a throbbing headache. Delirium is sometimes seen. The temperature in the rectum is no higher than in the cold stage and may be lower. This stage lasts for 3 or 4 hours and is accompanied by the most tormenting thirst. This picture changes rather abruptly as a rule for that of the sweating stage.

SWEATING STAGE.—Drops of sweat appear on the face and gradually the whole body becomes bathed in moisture. The sweating may be drenching or slight, but with its appearance the uncomfortable symptoms subside and the patient falls into a sound and refreshing sleep as a general thing.

These paroxysms are repeated every other day in tertian fever and every fourth day in quartan fever, but there may be double or mixed infections whereby successive crops of the parasites mature daily, twice daily, on two successive days with an interval of a free day, and so on.

COURSE OF THE DISEASE.—After a few paroxysms the patient may recover without medication. The infection may persist for years, and relapses are common, frequently following accidents or operations involving loss of blood, or childbirth. Persistent fevers of this type may cause anemia and malarial cachexia.

ESTIVOAUTUMNAL FEVER.—This type of fever is irregular and remittent rather than intermittent as a rule. It may resemble the

double or triple infections alluded to above, and the paroxysms are not nearly so apt to show the three stages, either the cold or sweating stage or both, being at times absent for several days. The rise in temperature and its decline are apt to be slow and gradual, and the paroxysms may anticipate—come daily at an earlier hour. The type of fever is more like that of typhoid than the other malarial fevers and may be continuous or remittent. The cases vary much in severity, and may be very light or pernicious, or with choleraic symptoms. The confusion in the diagnosis of this fever is added to by the fact that it occurs in the autumn when typhoid is apt to be prevalent, and it should not be forgotten that both infections may co-exist.

Diagnosis.—This is made by blood examination, the fresh blood being preferable, examined before coagulation. Dried specimens, unstained or stained will also show the parasites. By the microscope it is possible to differentiate a double tertian from a triple quartan and both from an estivoautumnal, and all three from typhoid. The Widal reaction should not be omitted as a malaria may be succeeded or accompanied by a typhoid.

Prophylaxis.—This is to be obtained in two ways; by destroying the parasite in the bodies of its human carriers—especially in children who often have malaria without much disturbance—by the persistent use of quinine, and in grave cases, the organic arsenic compounds; and by destroying the Anopheles mosquitoes wherever found, as is more fully described in the special chapter on the subject (page 281).

DENGUE.

Synonyms.—Breakbone Fever; Dandy Fever.

Definition.—Dengue is an acute epidemic infectious disease whose cause is unknown but which is spread by mosquitoes of the genus *Culex.* It is characterized by paroxysms of severe pain in the joints and muscles, aggravated by motion and accompanied often by great hyperesthesia. Fever is present and frequently eruptions of the skin are seen.

Etiology.—Various observers have found bacterial organisms, usually micrococci, but careful work has failed to confirm these observations. Both sexes and all ages are attacked, but the disease is limited to warm countries or warm seasons.

Incubation.—3 to 5 days.

Immunity.—One attack generally protects, but second or third attacks are sometimes seen.

Symptoms.—The onset is sudden, so abrupt that the Spanish call it *Trancaso* "A blow with a club." It frequently comes at night, and the patient, who has previously felt perfectly well or has suffered from only slight *malaise,* slight headache or chilliness, finds himself in severe or even agonizing pain, which may involve the head, loins, joints, muscles or the whole body. A peculiar and very characteristic symptom is the great hyperesthesia of some part of the body, particularly the soles of the feet, so that to have them touched is torture.

The fever is high, sometimes to 105° or 106°, the maximum occurring on the second to the fourth days, and declining to normal on the fifth day, when the symptoms all subside and the patient has a respite of a day or perhaps two when all the symptoms except sometimes the hyperesthesia subside. At the end of this time, the symptoms recur, generally in somewhat milder form, to continue for another 3 or 4 days, when convalescence sets in.

Delirium is rare except in children. The tongue is coated and red at the tip and edges; the appetite is lost or impaired, there are slight nausea, thirst, scanty urine, and constipation. During both paroxysms a rash resembling measles is present, according to personal experience, and the eyes may be reddened. The lymphatics of the neck, groin and other parts of the body are always swollen and painful.

A peculiar sequela often seen is a single painful joint, often of a finger or toe, which may remain for weeks.

Diagnosis.—The rash and the swollen lymphatics, together with the fact that the patient is not prostrated as one would expect with the severity of the symptoms, will fix the diagnosis.

Prognosis.—Death is very rare, but a poor state of health may persist for some time.

Prophylaxis.—As for yellow fever.

Quarantine.—Quarantine and disinfection are not required.

PELLAGRA.

Definition.—Pellagra is a chronic disease, showing periodical acute exacerbations, according to one view, or subject to reinfection according to the other view, which is characterized by debility,

erythema passing over into dryness and scaliness of the skin, digestive and nervous disturbances.

Etiology.—The etiology of the disease is not certainly known, there being two schools of opinion, the older of which regards the disease as being a chronic poisoning due to mycelial or chemical poisons developed in the spoiling of Indian corn, and the newer believes it to be borne by insects of the genus *Simulium*, the Sandflies or Buffalo Gnats. According to the latter view, the disease is communicable like malaria. This theory best explains the presence of the disease among those who rarely or never eat corn, its close adherence to territory where there are shallow rapid streams, its appearance with the first warm weather of spring and disappearance with the approach of winter, and the fact that it is practically always a rural disease. This view has been adopted here for the classification of pellagra.

Fig. 2.—The simulium fly and larva. (After Comstock.)

Symptoms.—PRODROMES.—Lassitude, vertigo, headache, general malaise, and sometimes mild digestive disturbances; all these symptoms are absent in some cases.

First Stage.—Burning sensations in mouth or stomach, altered sense of taste, loss of appetite and frequently salivation. Dyspeptic symptoms, with flatulence, vomiting and abdominal pain, diarrhea (occasionally constipation); bowel passages sometimes containing mucus and blood and being voided with pain and tenesmus. Tongue coated, and buccal mucous membrane reddened, with small blisters or even superficial ulceration.

In a short time the characteristic redness of the skin appears, coming out symmetrically and nearly always on uncovered parts of the body. It is accompanied by itching and burning of the skin, and swelling.

There is muscular weakness especially of the lower limbs, and the patients tire easily.

The temperature is usually normal, but may be slightly elevated at times, but the presence of much fever denotes complications of some kind.

Vertigo is often an annoying symptom, as are headache and insomnia; neuralgias may be severe, especially in the back, with

cramps in the extremities. The knee-jerks are apt to be exaggerated.

Eye symptoms are frequent, ranging from diplopia and amblyopia to cataract.

Blood changes are unimportant, and urinary changes except albuminuria and the presence of the diazo reaction are not frequent or characteristic.

Second Stage.—This is marked by an increase in the severity of all the above noted symptoms. A marked anemia supervenes; the skin becomes hard, dry, cracked and pigmented; the tongue is smooth and bare of epithelium (bald tongue). The diarrhea becomes more annoying and persistent, and is either serous or bloody; it may be painless and if continued brings on the third or cachectic stage.

The nervous symptoms become more prominent, and to the increase of these noted under the first stage are added the psychic symptoms, which usually take the form of melancholia. In the milder cases there may only be a slowness of thought, mental feebleness and aversion to any kind of activity. The severer cases present delusions of persecution, anxiety and frequently religious ideas predominate. Suicidal tendencies are common while homicidal ideas are rare. Food may be refused. Delirium of a melancholic character may occur, as may circular insanity and paranoia, while the end picture is apt to be dementia.

The muscular system suffers progressive enfeeblement, and partial paralysis, hemiplegia and paraplegia may occur.

A state like tetany, with paroxysmal, painful tonic contractions of the muscles are observed.

The gait is usually paralytic or paralytic-spastic, never ataxic. There are tremors of the upper extremities, head and tongue in many cases.

Various minor symptoms also occur.

Third Stage. The Terminal or Cachectic Stage.—The symptoms of the second stage are aggravated and emphasized, but new ones do not supervene. The cachexia is the most prominent symptom, with the mental symptoms a close second. The diarrhea often becomes uncontrollable and is the immediate cause of death. The paralyses and anemia also may terminate the case, or some intercurrent disease as pulmonary tuberculosis may intervene.

Typhoid Pellagra.—In this form the symptoms of the pellagra

become hyperacute and there are present all the symptoms of the profound prostration known as the typhoid state. It must not be confounded with true typhoid. Death usually occurs in this form within 1 or 2 weeks.

Pellagrous Erythema.—This is probably due to the chemical action of the sun's rays on a deficiently resistant skin, and appears first on the face and extensor surfaces of the extremities if they are exposed to sunlight, and afterwards on the flexor surfaces, but the palms and soles escape. Rarely, covered parts of the body are affected or the eruption is general. It usually develops first on the backs of the hands with itching and burning, almost precisely similar to sunburn. The red disappears on pressure but returns as soon as the pressure is removed. There may be large blisters with serum, which may become bloody or purulent. There may also be a thickening and drying of the skin, with subsequent peeling, without the formation of blisters. The scaling may occur in large flakes. The skin is pigmented for some time after the completion of the drying and desquamation. After repeated attacks it becomes thickened, hard and dry, its elasticity is partly lost, and fissures or thick crusts form, or there may be small ulcers left after the peeling takes place. Atrophic lines like those on the abdomen of a woman who has borne children are seen in old cases. In a few cases the rough skin is lacking—*pellagra sine pellagra*. This is believed to represent only a temporary condition.

Duration.—Pellagra is an exceedingly chronic disease ordinarily, and is very irregular in its development. A severe attack one year may be followed by a light one the next. An early spring favors the early recurrence of the attack. The disease is always more rapid and grave in children. The stages as here outlined have nothing to do with time, since some cases progress more in one year than others in twenty, and indeed some cases remain in the first stage for twenty years.

Diagnosis.—The diagnosis is based on the symptoms as here outlined, and particularly on the skin symptoms.

Prognosis.—Always serious, but dependent on the possibility of removing the patient to proper surroundings and a good food supply. In the first stage, recovery is the rule, in the second it may occur, but the intelligence is apt to be permanently enfeebled; in the third, death is the rule. Recovery may occur from typhoid pellagra, but is very rare.

It is an important disease on account of the large number of people involved and the destructive effects on society as well as the individual.

Prophylaxis.—Notwithstanding the tendency to ascribe an insect-borne etiology to the disease, spoiled corn should be avoided as an article of diet, and corn should in pellagrous communities be replaced by other grains. There is a two-fold reason for this, as it is possible that the maize theory of the etiology of pellagra is right, in which case the disease will disappear, and on the other hand, it may continue after the abandonment of corn as an article of diet, when the sand-fly theory will assume greater importance.

The disease is widespread in the Southern States, and extends at least as far north as Illinois, Kansas and Indiana. Reliable statistics of morbidity and mortality for the United States are not available, since the collection of vital statistics is very faulty over most of the affected area.

CHAPTER XI.

THE SEPTIC GROUP.

This group contains besides the two diseases treated in full, septicemia and pyemia, puerperal fever, and hospital gangrene. All are infections of wounds or abrasions in most instances, and all are preventable in any case which would concern the sanitarian as such by the application of the principles of surgical cleanliness. The etiology of the last four embraces also other infections than those of the streptococcus, as the terms are usually applied. For these reasons their detailed consideration is omitted.

ERYSIPELAS.

Synonyms.—The Rose; St. Anthony's Fire.

Definition.—An acute contagious dermatitis caused by infection with the *Streptococcus erysipelatis* (*S. pyogenes*), and associated with the usual signs of dermatitis, heat, swelling, pain, redness and a disposition to spread.

Etiology.—The infecting agent is a micrococcus, 3 to 4 mi. in diameter, the cells of which are associated in chains of from 2 to 12 or more members. This organism is introduced through some abrasion or gains entrance to the deeper layers of the skin through a hair follicle or sweat gland, and multiplies in the lymph spaces at first, afterwards passing into the blood stream, by which means it not infrequently infects distant parts. It is transmitted by contact, by infected articles or the hands of surgeons and nurses, and is believed, especially by surgeons, to cling to walls, bedding, infected articles or hands for a considerable time. Aerial carriage is not likely to occur except in cases of erysipelas involving the nose or mouth, in which droplet infection in coughing or sneezing might readily occur.

Incubation.—1 to 8 days; accidental inoculations have shown an incubation period of only a few hours.

Immunity.—Many people are not susceptible to the disease except by accidental inoculation; an antistreptococcic serum is made

which has produced rapid improvement in erysipelas, and which might well be used in cases where infection is thought to have occurred but in which the disease has not yet appeared. Vaccines after Wright's method are also made and employed with alleged good results. In connection with vaccines and sera, it is to be remembered that there are several strains of the streptococcus, and that the products made from one strain will not be as effective against other strains. Most of these are made from a combination of several strains, and are "polyvalent."

Symptoms.—The first symptom is a chill or succession of chills, with elevation of temperature and loss of appetite. A small elevated dusky red spot appears at the point of the initial lesion, which enlarges, with sharply defined edges, maintaining its elevation above the surrounding skin.

Fever is pronounced, reaching 105° or higher at times, and is associated with headache, frequent pulse, and in the more serious cases with delirium and the typhoid state.

Termination is usually by crisis at from the third to the fifth day, and the temperature remains at or near normal unless the infection is relighted.

The complications are focal lesions due to cocci carried in the blood stream, and are endocarditis, meningitis, deep abscesses, gangrene, septic nephritis, and pyemia or septicemia. Meningitis may occur by extension along the sheaths of the cranial nerves.

The disease has a rather marked tendency to relapse or recur, repeated attacks not being uncommon.

Prophylaxis.—Strict cleanliness is probably the only prophylactic measure necessary to prevent the spread of cutaneous erysipelas, but physicians in charge of such cases should not attend surgical or obstetrical cases without the most thorough disinfection of the person, change of clothing, and the use of long rubber gloves. Rooms in which such cases have occurred should be disinfected before either of the above classes of cases is admitted into them, since septicemia, pyemia, puerperal fever, and probably such cases of the formerly terrible hospital gangrene as are not due to the capsule bacillus (*B. aerogenes capsulatus*) are almost always streptococcic infections.

Isolation of the patient is desirable, but quarantine is not required.

TETANUS.

Synonym.—Lockjaw.

Definition.—An infectious disease caused by the inoculation and growth of the *Bacillus tetani,* which is normally found in soil, in putrefying fluids, in manure, and in the alimentary canal of herbivorous animals. It is characterized by tonic spasms of the muscles, with acute exacerbations.

Etiology.—The morbific agent is the one noted in the definition, which gains entrance through a wound, and there multiplies, although in the so-called idiopathic tetanus no wound is discoverable.

The bacillus of tetanus is a slender rod with rounded ends, non-motile, completely anærobic, and is spore-bearing. The bacilli with included spores resemble a drumstick or round-headed tack in shape. It is not killed by a temperature of 176° in the actively growing state, while the spores are highly resistant to heat and drying. Unless in deeply punctured wounds, aerobic pus-germs must also be present to take up the available supply of oxygen, or the tetanus bacillus is unable to multiply.

They do not ordinarily pass into the circulation, but remain sharply localized at the point of inoculation. Hence the disease is due to the toxins given off, which pass into the circulation and become fixed in the protoplasm of nervous tissue, causing the characteristic symptoms. This has often been proved by the injection of the filtered products of the growth of the bacilli. These are several in number, and comprise at least two alkaloidal bodies and one toxalbumin, and owing to their various actions, different clinical pictures are shown as one or the other predominates.

Certain localities are unenviably notorious for the number of cases of tetanus, and the disease occasionally becomes epidemic.

Pathology.—Nothing distinctive is found post-mortem.

Incubation.—From 5 to 15 days.

Symptoms.—Rarely a chill presages the disease. Usually the first sign is a stiffening of the neck and muscles of the jaws. The patient opens the mouth with difficulty. This stiffness then extends to the back, abdomen, and muscles of the extremities, and when complete the whole body is held rigid in either a straight or flexed position as though it were of wood (Tyson). The jaws in severe cases become locked, but are sometimes possible to open forcibly. The eyebrows are raised, and the corners of the mouth

also, producing the so-called "sardonic grin." This is not always present even in fatal cases. In other cases the clonic convulsions may take the place of the extreme tonic spasm, and death may occur, as in a personal case, in the first convulsion before more than a slight stiffening of the jaw and neck muscles had occurred. Both tonic and clonic spasms are very painful and are aggravated by slight stimuli.

The temperature is usually not over 102° but may go to 105° or even 110°. The pulse is very rapid, 130 to 150, and the respirations are from 30 to 50 per minute.

Diagnosis.—Tetanus is differentiated from strychnine poisoning by the absence of rigidity between the paroxysms, by the greater involvement of the extremities, by the history of the case, and by the absence of lockjaw in the latter condition. A comparison of the symptoms of hydrophobia (see page 125) will readily enable that disease to be excluded; cerebrospinal fever (page 163) and parotitis (page 113) will seldom give rise to difficulty.

Prognosis.—Of traumatic tetanus cases about 80 per cent die, but of the idiopathic cases less than 50 per cent. Since the focus of infection in the latter cases is not discoverable, naturally it is usually smaller, the amount of toxins produced is smaller, and death is less frequent because a small dose kills less often than a large one. Incubation periods under 8 days are very unfavorable.

Prevalence.—The number of deaths in the registration area is very uniform, having stood at a point in the neighborhood of 1,150 for 9 years past. Recent statistics show a marked improvement for the country at large in a single class of tetanus cases, those due to accidents with explosives on July 4th. In 1903 these presented the grim total of 415, in 1908, 76, while the "Sane Fourth" idea, together with prompt cleansing and opening of wounds and the administration of antitoxin, reduced the mortality in 1911 almost to the vanishing point. In Great Britain, on the contrary, it is rising for some unknown reason.

Prophylaxis.—In addition to the opening and loose packing of all wounds likely to become infected, hydrogen dioxide should be freely used as supplying large quantities of oxygen within the wound, and prophylactic doses of antitetanic serum should be employed. Owing to the fixation of the poison within the nerve tissues, the curative use of the serum is likely to disappoint.

No isolation, quarantine or disinfection is necessary.

CHAPTER XII.

THE TUBERCULOSIS GROUP.

The two diseases in this group, tuberculosis and leprosy, have much in common. Both are the result of infection by acid-fast bacilli, both are highly chronic, not highly infectious, have a very long incubation period, are difficult to treat when well established, and have many pathological features in common. They thus form a very natural epidemiological group.

TUBERCULOSIS.

Definition.—An infective disease caused by *Bacillus tuberculosis,* the lesions of which are characterized by nodular bodies called tubercles or diffuse infiltrations of tuberculosis tissue which undergo caseation or sclerosis and may finally ulcerate, or in some cases calcify (Osler).

Etiology.—Tuberculosis is an exceedingly widespread malady, affecting almost all warm-blooded animals under proper conditions. Cold-blooded animals are practically immune, since their body temperature is below that required for the development of the bacillus. To the sanitarian, the salient feature is the frequent infection of bovine animals, upon whom man depends so largely for meat and milk.

Tuberculosis is the most wide-spread of all the infectious diseases, being responsible for 78,289 deaths in 1908 in the Registration Area of the United States, a mortality rate of 173.9 per 100,000; 67,376 of which were tuberculosis of the lungs, with a rate of 149.6 per 100,000. The death-rate from tuberculosis is steadily decreasing, having decreased every year from 1904, when it was 201.6 per 100,000, to 1908, when the figures were as above quoted. It is an urban, rather than a rural disease, as shown by the fact that the cities in registration States give a rate of 198.3 while the rural parts of the same States show only 136.6 per 100,000 (1908).

From 1890 to 1900, the death-rate from pulmonary consumption

in the whole United States registered a fall of 22.4 per cent while the general death-rate fell only 9.4. Similar statistics are available from many sources, but those shown are sufficient to demonstrate that tuberculosis is not only a preventable disease, but is actually being prevented.

Race.—Indians and negroes are particularly susceptible to the various forms of tuberculosis, while the Irish among white peoples seem to be more liable than their neighbors. Jews, who were for 2,000 years urban dwellers, and who may be supposed to be well adapted to city life, have a mortality of only about half that of their Christian neighbors.

Bacillus Tuberculosis.—The bacillus of tuberculosis is a short fine rod, often slightly bent or curved, about 3 to 4 mi. in length. It sometimes branches or shows lateral outgrowths. It is difficult to stain, requiring a mordant to fix the dye, but when stained the stain is not attacked by dilute acids, which fact enables the bacillus to be readily found in mixtures. It must not be forgotten that a number of other organisms are also acid-fast, although the only one likely to be confused with *B. tuberculosis* in ordinary work is the smegma bacillus in urine examinations.

Modes of Infection.

(1) *Congenital.*—This is excessively rare so far as absolutely proved cases go and may be dismissed with this statement.

(2) *Inoculation.*—This mode of infection is possible, but rarely produces more than local lesions at the inoculation site or involvement of the next group of lymphatics.

(3) *Inhalation.*—This is possible by two modes, inhalation of dried dust containing bacilli and inhalation of droplets thrown off in coughing, sneezing or speaking. This is beyond question an important avenue of infection, but of the two possible ways in which the bacilli may be air-borne that by droplets is much more important. Dust infection is possible but is less likely to occur than droplet infection.

(4) *Ingestion.*—The bacilli are frequently swallowed in food prepared or handled by the tubercular, in milk which is either from tubercular cows or infected by human carriers, and perhaps through putting one's own fingers into the mouth after they have been infected from some source. This latter Chapin regards as the important method. However the bacilli enter the mouth, they may

infect the tonsils and secondarily the cervical lymph nodes, the mediastinum, the lymph channels and the lungs. Or they may be taken up from the intestine without infecting it and pass to the lungs and other organs in the lymph stream. Milk is very often infected, Hess finding 16 per cent of the 107 specimens he examined in New York to be infected. It is not believed that milk infection is extremely common, however, as only about 5 per cent of all cases of tuberculosis contain the bovine type of bacilli.

Conditions Favoring Infection.—Age and sex present but slight influence. The main factor above all others is lack of fresh air, however it is produced. Adenoids and enlarged tonsils or enlarged turbinates cut off fresh air from the individual, as also do certain heart lesions. Overcrowding or lack of ventilation, especially in sleeping rooms cuts off oxygen from several or many. It is not to be inferred that oxygen-starvation is the only factor to consider, but it is an index which cannot be neglected. Animals free from tuberculosis in their wild life become quickly victims of the disease in captivity. The same is true of races of men accustomed to a free life when they become town dwellers.

Pathology.—Distribution of Lesions.—In children the lymph-nodes, bones and joints are most frequently attacked; in adults, the lungs. Almost every tissue of the body has been found at some time or other to be the seat of tuberculosis lesions. While the whole subject of prevention of tuberculosis is important to the sanitarian, the two forms which give him most concern are pulmonary tuberculosis (phthisis or consumption) and tubercular meningitis. The first is important because it is a source of infection and the latter because it may simulate rather closely cerebrospinal fever.

Changes Produced by the Bacilli.—The tubercle is not a lesion distinctive of tuberculosis, since similar structures are found in actinomycosis and other parasitic infections. Baumgarten gives the following history of the development of the tubercle:

(a) The bacilli multiply rapidly and are disseminated in the surrounding tissues by growth and through the lymph stream.

(b) The fixed cells multiply and from the connective tissue cells and capillary endothelium develop variously shaped cells with vesicular nuclei, the *epithelioid cells,* inside of which are seen tubercle bacilli.

(c) There is a local leucocytosis, at first of the polynuclears and afterwards of the lymphocytes.

(d) A reticulum of connective tissue fibrils forms which can best be seen at the edge of the section of tubercle.

(e) Giant cells are formed in some tubercles, not in all. In the chronic varieties, like that of bone, lymph-glands and the skin (lupus), these giant cells are rather abundant, but in acute lesions are rare or wanting.

THE DEGENERATION OF THE TUBERCLE.

(a) *Caseation.*—The central part of the tubercle coagulates, the cells lose their outline, fail to stain properly, and are converted into a homogeneous yellowish-gray mass, in which no blood vessels are to be seen. These cheesy masses may suppurate, become encapsulated, or calcified.

(b) *Sclerosis.*—In place of the softening into caseous substance, the fibrous elements may multiply, afterwards undergoing contraction, until only a hardened mass of scar tissue is left. This is the favorable termination. Either form of degeneration may leave, even after years, bacilli demonstrable by inoculation into the guinea-pig, although the lesion may have been entirely harmless to its original host for a long period. Calcification is said to occur with much greater frequency when the infecting bacilli are of the bovine type.

Symptoms.—Tuberculosis is a disease of so protean a type that its symptomatology is far too complicated to consider in a work so limited as this. For the symptoms of the disease the reader is referred to any standard work on practice or to the special works on tuberculosis. It will be sufficient to point out here that acute miliary tuberculosis at times simulates typhoid fever, and at others cerebrospinal fever. From the one it may be distinguished by the absence of the Widal reaction and the presence of the tuberculin reaction; from the other, by the presence of the tuberculin test and the absence of the diplococci on exploratory spinal puncture.

Diagnosis.—If the tubercle bacilli can be detected in any of the bodily discharges or in an excised lesion, the diagnosis is made. For the method of performing this, see page 351, Part III.

TUBERCULIN REACTIONS.

Four methods of making the tuberculin reaction are in use.

(a) *The Hypodermic Method.*—This is the oldest, dating back to Koch's early work. It consists in giving hypodermically 1 mg.

of old tuberculin (T. O.), whereas if the reaction is positive there will be a rise of temperature to 102° or 104° inside of 10 or 12 hours. In case this gives no reaction, double the amount is employed 2 or 3 days later. If there is no rise of temperature, the patient may be considered not to have tuberculosis. By some writers there is thought to be danger of relighting an old tubercular process by this method.

(b) *Calmette's Reaction.*—A drop of one-half or 1 per cent solution of tuberculin is placed in the conjunctival sac. If tuberculosis is present there will be a reddening of the conjunctiva within 12 hours. This conjunctival hyperemia is sometimes too active, and is a reason why the Calmette method is not safe for a novice.

(c) *The Moro Test.*—An ointment of tuberculin in lanolin is rubbed into the skin with a spatula. Hyperemia of the skin within 24 hours is held to indicate tuberculosis. A control should be made by rubbing a little plain, sterile lanolin into the skin at a little distance, with the same instrument for the same time. This test is somewhat unreliable on account of giving positive results in cases which never develop any clinical symptoms. A positive reaction is indicated by a crop of small red papules in 24 to 48 hours.

(d) *The von Pirquet Percutaneous Reaction.*—The skin is cleansed with ether, which is allowed to evaporate. A dull scarificator is employed sufficiently to redden the skin and divest it of superficial epithelium without opening the blood or lymph channels. A similar place is made at a distance of a couple of inches, the thin hairless skin on the palmar surface of the forearm being the usual site for this test. To one scarified area is applied the tuberculin, and to the other normal salt solution. They are then allowed to dry and a sterile plain gauze pad applied. In 24 hours a positive reaction will be indicated by an erythematous blush raised in the center to a vivid red papule. The tuberculin used is of the strength of 25 per cent.

Prophylaxis.—The means of reducing the death-rate and morbidity rate from tuberculosis are several:

1. *Education.*—The people in general should be informed by every means that tuberculosis is a preventable and often a curable disease.

2. *Reports.*—Tuberculosis should be reported as regularly as smallpox. The sanitary authorities are then in position to see

that the general public is protected, and that the family of the patient and the patient himself are protected against carelessness on his part.

3. *Housing.*—Improved housing, with due regard for ventilation and opportunity for cleanliness always lower the sickness and death-rates from tuberculosis.

4. *Antispitting Ordinances.*—These are referred to elsewhere, and are valuable only when enforced. The education of the patient is more important ordinarily.

5. *Segregation of the patients* into hospitals and sanatoria where they cease to be a menace to the general public and have a better chance to recover.

6. *Sputum.*—This must be properly cared for in destructible paper cups or napkins, which are best burned, but may be immersed in 5 per cent carbolic solution or 2½ per cent cresol. Formaldehyd and bichloride solutions are not reliable, since they coagulate the sputum without destroying the bacilli in the center of the lumps.

7. *Persons who are deemed in danger of becoming tubercular* should seek fresh air, good food, comfortable and suitable clothing, climate and season considered, and should have every possible bodily ailment such as catarrh, adenoids, enlarged tonsils or anything which tends to reduce them below par, attended to. Cool sponge baths, followed by brisk rubbing with a rough towel, are useful, but should only be used when a warm glowing reaction follows. Meals and sleep should be regular and plentiful.

Out-of-door sleeping is a delight when one is properly prepared, and should be fostered whenever possible.

The minor infectious diseases, as well as the more serious ones, including scarlet fever, measles and whooping cough should be watched, should they occur in a delicate child, and their frequently disastrous after-effects prevented so far as possible.

Artificial Immunity.—Of late efforts are being made toward the establishment of active immunity against tuberculosis by the inoculation of very small numbers of bacilli of low virulence. The experimental work seems very hopeful, and was suggested by the fact that persons who have recovered from bone or glandular tuberculosis, which normally is of low virulence, are very generally immune thereafter to the disease.

Isolation.—Under the name of offering a cure, the States and

private philanthropy are providing isolation for the sick. While the isolation is a secondary consideration to the philanthropist, it is the primary consideration to the sanitarian. There is no question that it would be best if all tubercular cases could be treated in these special hospitals, since they not only present a percentage of cures superior to that possible in private practice, but they educate the patient so that when he returns home he is a source of information to his neighbors, and during the time of active progress of the disease is where his carelessness can be minimized and checked.

Disinfection.—It was formerly thought impossible to kill the tubercle bacilli with formaldehyd, but if conditions are properly looked after, and the necessary amount of moisture is present, there is no trouble in doing it. It is well to supplement the use of formaldehyd disinfection (which should last for at least 6 hours) with 2½ per cent cresol solution, sprayed or mopped on.

LEPROSY.

Definition.—A chronic infectious disease caused by *Bacillus lepræ* characterized by the presence of tubercular nodules in the skin and mucous membranes (tubercular leprosy) or by changes in the nerves (anesthetic leprosy). At first these forms may be separate, but ultimately both are combined, and in the characteristic tubercular form are disturbances of sensation (Osler).

Distribution.—This disease has been known for several thousand years, and was widely distributed in ancient and mediæval times throughout the Old World. In the Sixteenth Century it began to decline, and has disappeared from Europe except in certain localities, which are in Scandinavia and Russia on the north and Spain and Portugal on the south. In the Orient, particularly in China, it is common. In the United States the number of known lepers will run to few over 100, who are principally in State leprosaria in Massachusetts, Minnesota, Louisiana and California. In the Insular Possessions, the great leper settlements at Molokai in the Hawaiian group and Culion in the Calamianes group of the southern Philippines are well known. Where the disease is not kept under control by isolation, it tends to spread.

Etiology.—The *Bacillus lepræ* much resembles the tubercle bacillus, and is acid-fast like the latter. It is only recently that it has been cultivated successfully on artificial media, by first growing

the germ in symbiosis with species of ameba, and after accustoming it to artificial conditions, growing it in pure culture.

Modes of Infection.—Inoculation.—Inoculation experiments free from doubt are not yet accomplished.

Heredity.—There is no reason to regard leprosy as a hereditary disease. In fact all the evidence and weight of opinion are against it.

Contagion.—The bacilli are given off in the nasal secretion, in the saliva, sputum, and the secretions from the specific ulcers. The portal of infection is by many authors believed to be the nasal mucous membrane, and the means, inhaled dust or droplets of saliva containing the bacilli discharged from the mouths of lepers in talking and coughing. It is also believed that it may be carried through infected clothing, a theory to which the high percentage of washerwomen affected gives color.

The collateral factors necessary for the development of a leprous infection are not known. It has been thought to be connected with a fish diet eaten raw, but the proof is by no means definite.

Pathology.—The leprous tubercles consist of granulomatous tissue made up of cells of various sizes in a connective tissue matrix. The bacilli in extraordinary numbers lie partly between and partly in the cells (Osler). These tubercles break down and ulcerate and cicatrize, all stages of development of the tubercles and all stages of ulceration and cicatrization being seen at the same time in some cases. The mucous membranes, as that of the larynx and the cornea may become involved, causing loss of voice or blindness. There may also be extensive loss of tissue as whole fingers or toes or their phalanges. In anesthetic leprosy, the characteristic lesion is the development of the bacilli in the peripheral nerves, causing a neuritis. This involvement of the nerves is responsible not only for the anesthesia but for various trophic disturbances.

Clinical Forms.—Tubercular Form.—Before the appearance of the tubercles there are areas of skin redness which are often sharply defined and tender. These spots in time become pigmented. Sometimes this occurs without the development of tubercles, the areas become anesthetic, lose their pigment and the skin becomes perfectly white. It may be a long time after the development of the disease thus far before it goes any farther, but to one acquainted with leprosy the diagnosis is clear.

As a next step, the facial hair and beard fall out, the mucous

membrane of the mouth, throat and larynx becomes involved, and the voice is husky or lost. Aspiration pneumonia may end life, and sloughing of the cornea may cause blindness.

Anesthetic Form.—Externally, this does not resemble the first-described type in the least. It begins with pains in the limbs and areas of numbness or tenderness. Small blebs may form as a result of trophic changes. The pigmented spots described in the preceding paragraph with their attendant involution are seen, but the anesthesia may occur outside of these spots. Where the nerve trunks can be felt they are hard and knotted. Trophic disturbances are apt to be severe, and the blebs occurring in the skin over these disturbed areas are apt to slough, leaving intractable ulcers, and sometimes great loss of substance. The loss of fingers and toes as a result of the trophic disturbances rather than the ulcerations and contractures are seen. As a whole the disease is extremely chronic, Osler mentioning a prominent clergyman who was a victim of the disease for 30 years without its interfering with his life and career in the slightest.

Diagnosis.—This is made by the appearance of the pigmentations, anesthesia, trophic disturbances and tubercles. In case the sanitarian, inexperienced in the diagnosis of the disease wishes help, he can always obtain it from the Public Health Service by making his need known through the State Board of Health or directly to the Surgeon-General of that service.

Microscopic examination of the secretion from ulcers or the nose will enable an earlier diagnosis in some cases.

Prognosis.—Of late years recoveries are being reported from several of the leprosaria. Heretofore the disease has been regarded as hopeless.

Quarantine.—Permanent isolation. In spite of the fact that leprosy is not highly contagious, isolation is the only proved method of preventing its spread.

Disinfection.—As for tuberculosis.

CHAPTER XIII.

THE TYPHUS GROUP.

This small group constitutes, along with Rocky Mountain Tick Fever, which is omitted on account of the small area involved and the prospect of its early extinction, and a rather larger number of tropical diseases, a unit whose one characteristic is dissemination by wingless insects. Plague, although frequently transmitted by the flea, is also directly contagious, especially in the pneumonic forms, and is omitted for that reason.

TYPHUS FEVER.

Synonyms.—Exanthematous Typhus; Putrid Fever; Ship Fever; Jail Fever; Pestilential Fever; Petechial Fever; Camp Fever; Tabardillo (Mexico).

Distribution.—Endemic in Asia and Eastern Europe; also in Mexico. Sporadic in Western Europe, the United States and Canada.

Etiology.—Long thought to be a filth disease; highly infectious, but no specific organism yet isolated. The special route by which the infection is carried was also unknown but body lice are now known to be the agents, with the bedbug under suspicion.

Pathology.—Nothing distinctive is found. The spleen is enlarged and the liver and kidneys are the seat of cloudy swelling. Granular degeneration of other organs including the heart may be present. The blood is dark and liquid and rigor mortis may be delayed. The peculiar petechial eruption remains after death, and there may be gangrenous bed-sores. Hypostatic congestion of the lungs is often found.

Incubation.—12 days, approximately.

Predisposing Factors.—Fatigue; poor nourishment.

Prodromes.—None, onset sudden.

Symptoms.—Chill; headache; great pain in back and muscles; temperature rising rapidly to 103° and 106°. Pulse at first full and strong, afterwards rising to 120 and becoming weaker. Con-

junctivæ congested, face dusky, expression dull, low muttering delirium. Tongue dry and coated. Bowels constipated. Eruption comes out on third to fifth day, and is of two kinds, petechial and mottled. The first variety is not unlike that of typhoid, but is darker and disappears less easily on pressure; when well established it disappears not at all. When the stage of non-disappearance is reached, the blood is already outside the vessels. All stages of the eruption may be seen at one time in the same case.

With the beginning of the second week all the symptoms deepen. The tongue becomes fissured, there is sordes on the teeth, the stupor deepens, there is *coma vigil,* in which the eyes are wide open though the patient is unconscious, there are nystagmus and twitching of the tendons. A peculiar odor, disagreeable and ammoniacal, and thought by some to be characteristic is present.

Albuminuria and retention of urine are often seen. Bronchial catarrh, cough, broncho-pneumonia and gangrene of the lungs may complicate matters. Gangrene of the extremities may occur.

Diagnosis.—Early high temperature; initial chill (frequently); petechiæ dark, not much disappearing on pressure; great prostration; much pain; morning remissions slight or none; serum reactions negative to typhoid and paratyphoid; no cocci in spinal fluid; *ambulant cases sometimes met.*

Differentiation.—Differentiate from hemorrhagic smallpox; cerebrospinal meningitis; malignant measles; bubonic plague.

Termination.—In fatal cases from exhaustion, hypostatic pneumonia, or gangrene of the lungs; in non-fatal cases by crisis at the end of the second week. Convalescence often slow but relapses are rare.

Prognosis.—The mortality is high, from 12 to 50 per cent in different epidemics, averaging about 20 per cent.

Quarantine for Sick.—Strict, until convalescence is thoroughly established, 4 weeks at least. Treatment should be carried on in tents or open pavilions for the safety of the attendants as well as for the good of the sick.

Quarantine for Contacts.—14 days. Strict.

Individual Prophylaxis.—Personal cleanliness; avoid all unnecessary contact with the sick; rubber gloves when handling patient; avoid fatigue.

Community Prophylaxis.—Clean up and whitewash all dark filthy places; burn sulphur freely in such localities, or if unin-

habited use first hydrocyanic acid to kill all animal life; rigidly quarantine all suspects, preferably in tents in an isolation camp. Use liquid disinfectants such as phenol and cresol derivatives freely in all suspicious places and on all sick room waste and excreta; such things as can be destroyed by fire should be burned. Use steam disinfection to kill lice in clothing, and mercurial ointment on any part of body showing "nits."

Disinfection.—Sulphur, formaldehyd with camphor for inhabited places; if the building can be entirely emptied of people, first use hydrocyanic gas. (*Caution.*) Liquid disinfection, steam, boiling or burning for contaminated articles.

Atypical Typhus.

A mild atypical fever known as "Brill's Disease" has been rather widely encountered in the United States, and is shown by inoculation experiments on monkeys to be identical with typhus, an attack of either disease immunizing against the other.

RELAPSING (SPIRILLUM) FEVER.

Synonyms.—Febris recurrens; Famine Fever; Seven Day Fever; Typhus icterodes.

Definition.—Relapsing fever is an acute infectious disease characterized by two or more total remissions, produced by infection with the *Spirochœte obermeieri.*

Distribution.—Endemic in Europe and Asia; rarely in small epidemics in United States.

Etiology.—The Spirochæte (Spirillum) obermeieri is a protozoön $2\frac{1}{2}$ to 8 mi. in length and 2 to $2\frac{1}{2}$ mi. in greatest width of spiral. It is found floating free in the blood during the paroxysms but disappears during the intervals between, while small glistening spherules supposed to be spores take their place. Relapsing fever is a disease of overcrowding and misery, rarely attacking the well-to-do. All ages, both sexes and all nationalities are attacked and season is without influence. It is highly infectious, and is possibly transmitted by droplet infection, but more probably by the bites of insects, such as bedbugs and lice.

Pathology.—The only constant gross change to be found is a splenic enlargement. Otherwise the conditions somewhat resemble typhus.

Predisposing Factors.—Poor food and fatigue.

Incubation.—2 to 14 days.

Prodromes.—Rarely malaise and loss of appetite. Usually none.

Symptoms.—Invasion abrupt, with chill, fever, intense pain in back and limbs, with dizziness. Temperature quickly to 104°; pulse on second day to 140, 150, or 160; there may be nausea, vomiting, and delirium, and in children, convulsions; tongue remains moist; there is jaundice on third or fourth day in 6 to 20 per cent of all cases. Sweating and sudamina may be present, and sometimes petechiæ or herpes, or a mottling like that of typhus, but disappearing on pressure. Abdominal tenderness is sometimes seen, and the liver may be enlarged.

Termination is by crisis on the sixth or seventh day, the temperature going to normal or below. Crisis may be preceded by diarrhea, nose-bleed or the menstrual flow.

Relapse takes place in about one week; the paroxysm is repeated, and a crisis is reached at a somewhat shorter interval. This may be repeated as often as five or six times, the seizures becoming shorter. Convalescence is usually rapid, but may be long.

Complications.—Bronchitis; nephritis; rupture of the spleen from over-distension; pneumonia; abortion in pregnant women with death of the fetus usually occurs. Toxic paralysis and ophthalmia accompany some epidemics.

Differentiation.—Differentiate from typhus; smallpox; influenza; dengue; malaria.

Prognosis.—In Great Britain and Ireland, 4.3 per cent is the average mortality for several years. In Bombay, an epidemic showed a little over 18 per cent and the one in Philadelphia, 14 per cent.

Quarantine.—Should continue till the spirilla are absent from the blood for several days after the time for the relapse to take place. Contacts should be held under observation but not necessarily quarantined till 14 days have expired.

Prophylaxis.—Both individual and community are secured by a general clean-up campaign, with feeding of the destitute, and the destruction of bedbugs, lice and other predacious insects, together with care to avoid unnecessary contact with the patient by physicians and nurses.

Disinfection.—Preferably by strong bichloride or cresol compounds applied to all cracks and crannies with a mop, and weaker solutions applied to the walls and floors. Sulphur or hydrocyanic

acid fumigation to destroy insects may be used if the house can be emptied temporarily.

TROPICAL SPLENOMEGALY.

Synonyms.—Tropical Cachexia; Piroplasmosis; Leishmanniasis; Dum-Dum Fever; Kala Azar.

Definition.—A chronic disease of tropical and sub-tropical countries, characterized by enlarged spleen, anemia, irregular fever of a remittent type, due to infection with a protozoön, *Leishmania dorovani.*

Distribution.—This disease is found in India, Assam, China, Ceylon, Egypt, the Mediterranean coast of Africa, and Greece.

The Parasite.—This was discovered first by Leishman in 1900, and shortly afterward the subject was taken up by a number of workers, whose work has been confirmatory. The organism is found most abundantly in the spleen, the liver, mesenteric and other lymphatic glands, intestinal and skin ulcers, but not in the peripheral blood in chronic cases. It is variously shaped, being oat-shaped, oval or circular, has a spherical nucleus close to the capsule with a short rod-shaped body on the opposite side. They may be closely applied to each other in pairs or groups or rosettes.

While the *Leishmania* is most readily found in the splenic blood, splenic puncture is not safe for the purpose of obtaining it, since fatal hemorrhage or rupture of the spleen may be precipitated by the ordinarily trifling operation. On the contrary, a diagnosis cannot be made without the discovery of the parasite. The best and safest way of doing this is to dissect out under local anesthesia, one of the superficial cervical or inguinal lymph-nodes, cut it, smear the cut surface on a slide and stain with the Wright, Leishman or Giemsa stain (Cochran).

Symptoms.—Leishman's description of the symptoms is as follows: "Splenic and hepatic enlargement—the former being apparently constant, while the latter is common but not invariable. A peculiar earthy pallor of the skin, and, in the advanced stages, an intense degree of emaciation and muscular atrophy. A long-continued, irregularly remittent fever of no definite type, lasting frequently for months, with or without remissions. Hemorrhages. such as epistaxis, bleeding from the gums, subcutaneous hemorrhages or purpuric eruptions. Transitory edemas of various regions or of the limbs." The red cells, notwithstanding the grave

anemia are not usually reduced below 2,000,000 per C. M. The white cells are also reduced in number, while a percentage count shows that the lymphocytes and large mononuclear cells are relatively increased.

Prognosis.—Almost uniformly fatal to dark-skinned races. Caucasians are not often attacked.

Mode of Infection.—By the bite of the common bedbug (Patton).

Prophylaxis.—The sick must be isolated away from bedbugs. The parasite is recently reported as destroyed by the newer organic arsenic compounds, as atoxyl and salvarsan. These should be employed not only as a therapeutic measure, but also for the purpose of destroying a focus of infection. Lastly, a determined campaign against bedbugs must be carried out.

CHAPTER XIV.

THE MENINGITIS GROUP.

This group consists of the two diseases, cerebrospinal meningitis and acute poliomyelitis. Both affect the central nervous system, and in both the portal of infection is probably nearly or quite invariably through the nasal passages. Both are highly but irregularly infectious, and the same measures available against the one are almost equally valuable against the other, with the exception that we do not yet possess a serum against acute poliomyelitis.

ACUTE POLIOMYELITIS.

Synonyms.—Epidemic Poliomyelitis; Acute Anterior Poliomyelitis; Infantile Paralysis; Epidemic Paralysis; "Polio."

Definition.—An acute infectious disease of protean aspects, involving the central nervous system, affecting both children and adults but chiefly children before the age of the second dentition.

Etiology.—The etiology of this disease is but little understood. It is known that the virus is still active after passing through a porcelain filter, as are the poisons of foot-and-mouth disease, yellow fever and a few others. It remains active in glycerine for months, like that of vaccinia, and resists drying over caustic potash for a long time. It is known to be present in the nasal secretions, like that of cerebrospinal fever, is thought to be transmitted by dust and by some insect, probably the fly, on account of its seasonal incidence being chiefly in the warm months. So far virulent cultures have not been grown outside the body. Monkeys are susceptible to the disease, and most of the experimentation on animals has been done with them. There is ground for hope that a method of immunization may soon be found, although as yet none is known.

The sanitarian must be on his guard against accepting conclusions concerning the etiology and symptomatology from text-books more than a year or two old, but should strive to keep informed on the subject from periodical literature. The literature of the sub-

ject is voluminous and most of it recent, and text-book articles are apt to begin to be obsolete before they are off the press.

Prevalence.—For the decade ending in 1904, 157 cases were reported in the literature, a figure probably much less than the true number, since it was not then reportable as an infectious disease. In the one year 1910, 8,700 cases were reported and the sanitary authorities of practically every State were engaged in a campaign to limit its ravages. Mortality reports are not available, but the State Board of Health of Indiana reports 60 deaths out of a total estimated morbidity of 300, both figures probably being too low, since fatal cases are apt to be reported as some form of meningitis, and there are many abortive or missed cases. As in other diseases, these mixed cases are the most difficult to control, and with "carriers" who can be suspected but not demonstrated as yet, are probably the most important factors in the spread of the disease.

Pathology.—At present it is believed that the first point of attack of the infection is the pia mater, usually beginning in the lumbar region and extending afterward to the cord and brain, or aborting without further extension, or extending to the dura mater, or involving many nerves without necessarily involving the central nervous system to any great degree. *The destruction of cells in the gray matter of the cord, medulla or brain with its consequent paralyses is not the disease, but the end result, and is comparable to other permanent toxic paralyses, as for instance the paralysis of the optic nerve due to wood-alcohol poisoning.*

Prodromes.—Slight or pronounced fever, pain in back and limbs, and slight catarrhal symptoms; nausea and vomiting. So far the symptoms are in no wise characteristic, but if to them is added *profuse sweating,* suspicion should be at once aroused, and the exhibition of hexamethylenamine should be begun at once, since experimental evidence has shown that this drug markedly modifies the toxicity and communicability of the disease.

Types.—The further progress of the disease is classified by Wickman as follows:

I. The spinal poliomyelitic type.
II. The type of ascending or descending paralysis, simulating Landry's paralysis.
III. The bulbar or pontine type.
IV. The encephalitic type.

V. The ataxic type.
VI. The polyneuritic type.
VII. The meningeal type.
VIII. Abortive types.

Symptoms.—The spinal poliomyelitic type is the one described in the text-books of more than five years ago. After the premonitory symptoms described above, which may have passed unnoticed, there is a rapid development of a paralysis involving one or more groups of muscles, which may remain permanent, but ordinarily recedes until only one or two groups are permanently paralyzed with a flaccid paralysis. It may, however, involve practically the whole body below the neck. The bulbar type involves the cranial nerves, with or without the spinal nerve-centers.

The other types simulate more or less closely the types of paralysis whose names are given to them, and approximate descriptions will be found in any text-book on nervous diseases, lack of space forbidding their introduction here.

The abortive types are the most baffling and are most apt to be overlooked until the general profession is much better informed on the subject than it is at present. In these the invasion symptoms are present, but the later paralyses do not develop. Instead there may be severe nausea and vomiting or diarrhea or all of these, apparently pointing to the elimination of the poison by the gastro-intestinal tract instead of its fixation in the central nervous system, precisely as the well-known toxins of diphtheria are sometimes eliminated without trouble and sometimes cause paralysis.

Some cases of the abortive type present symptoms of a more or less severe general infection, others of a meningeal irritation, and still others much pain and hyperesthesia such as are seen in influenza.

Diagnosis.—As yet impossible before the development of the paralysis in sporadic cases. In epidemics the abortive types are more apt to be recognized. In the meningeal type, the presence of a sterile spinal fluid, under pressure, will differentiate it from meningitis, but except in these cases spinal puncture is not to be recommended.

Prognosis.—The mortality varies from 3 to 15 per cent with an average of about 7 per cent. The majority of the abortive cases make complete recovery. The ascending, bulbar and meningitic

cases present the worst prognosis as to life, but even these rarely die after the seventh day.

Prophylaxis.—Isolation of the patient except for the necessary attendance. Screening from flies. All utensils coming in contact with the patient's mouth must be immediately disinfected. All nasal or buccal secretions must be immediately destroyed by burning or by efficient chemical germicides. The physical condition of other members of the family must be carefully looked after. The case must be reported at once to the authorities, who will see that the latest information is placed in the hands of the physician. Both the profession and public must be educated to a knowledge of the dangerous infectiousness of the disease.

Quarantine.—At least 28 days; modified.

Disinfection.—Terminal disinfection with formaldehyd is advisable, although not everywhere required.

CEREBROSPINAL FEVER.

Synonyms.—Spinal Meningitis; Cerebrospinal Meningitis; "Spotted Fever"; Malignant Purpuric Fever; Petechial Fever.

Definition.—An infectious disease, occurring sporadically and in epidemics, caused by the *Diplococcus intracellularis,* characterized by inflammation of the cerebrospinal meninges and a clinical course of great irregularity (Osler).

Etiology.—Cerebrospinal fever occurs both in sporadic and epidemic forms, the epidemics usually being localized and affecting country districts ordinarily more in proportion than cities. Mining districts and seaports have suffered most severely. It is a military disease of importance, and is always to be reckoned with whenever recruits are concentrated for the first time in camps or barracks.

The greatest incidence occurs in childhood and young adult life, the disease decreasing in frequency from the first years of life, about 65 per cent according to the United States Census Report for 1904 occurring under the age of 5 years. Fatigue, misery, and poor nutrition are important factors in aiding the dissemination of this disease.

According to Flexner's very careful experimental work on apes and monkeys, the disease is most probably contracted through infection of the nasal mucous membrane by the diplococcus. The organism may be recovered from the nasal secretion of patients

sick of the disease and also from that of "carriers" who may or may not be immune to the disease. When the intimate connection and short route existing between the mucous membrane of the nose and the cerebral meninges is considered, it is easy to see the ease with which infection of susceptible persons can occur.

THE DIPLOCOCCUS INTRACELLULARIS.—This organism is characterized by the great regularity with which it is found inside the polymorphonuclear leucocytes. Superficially it resembles the *D. lanceolatus* (Pneumococcus) and is akin to it in being able to cause both pneumonia and meningitis, but is quite different from it in cultural characteristics. It is found, as before stated, in the nasal secretion of the sick and of healthy contacts, in the cerebrospinal fluid regularly, and sometimes in the lungs; it has also been cultivated from pus, the joints, from pneumonic areas in the lungs, and with comparative ease from the blood.

Pathology.—In malignant cases death may occur before any characteristic changes have taken place, the brain and spinal cord showing only intense congestion. There is intense congestion of the pia-arachnoid. The exudate is of pus with fibrin flakes, most prominent at the base of the brain where the meninges may be greatly thickened and plastered over with it. The whole brain cortex may be covered with this type of exudate. Sometimes a fluid resembling pus is found between the dura and pia mater. The cord is always involved with the brain, and the exudate is more marked on the posterior surface and in the dorsal and lumbar portions rather than the cervical.

In the more chronic cases, the meninges are generally thickened and yellow patches here and there mark former sites of the exudate. In the acute cases, the ventricles are dilated and contain a turbid fluid or in the posterior horns, pure pus. In the chronic cases the dilatation may be very great. The brain substance has a pink tinge and is softer than usual. Spots of hemorrhage and of inflammation of the brain substance may be found. The cranial nerves are frequently involved, especially the second, fifth, seventh, and eighth. The spinal nerve roots are often surrounded by exudate.

Under the microscope the exudate consists chiefly of polymorphonuclear white cells closely packed in threads of fibrin. Minute abscesses or hemorrhages may be seen sometimes. The cells of the nerve-sheaths are swollen and show large, clear, vesicular nuclei. The ganglion cells are less changed. Diplococci are found in vari-

able numbers in the exudate, but are more numerous in that taken from the brain.

Other organs than the brain and cord show no constant characteristic changes, the organ most commonly involved aside from these being the lung, with a resultant pneumonia or pleurisy. Endocarditis is sometimes seen.

Symptoms.—Malignant Form.—This is of the fulminant or apoplectic type and shows a sudden onset, with violent chills, headache, somnolence, muscular spasms, great depression, moderate fever, and feeble pulse, which is often slowed to 50 or 60 per minute. There is usually a purpuric rash. The whole march of the disease from apparently perfect health to a fatal termination occupies only a little over 24 hours at most, and recorded cases have shown a duration of as little as 5 hours.

Ordinary Form.—The length of the incubation period is not known, and the disease usually sets in suddenly. Headache, pain in the back, vomiting and loss of appetite sometimes foreshadow the coming attack. The temperature goes up to 101° or 102°. The pulse is full and strong. An early and important symptom is stiffness of the neck muscles, which are quite painful on movement. The headache becomes more severe, the eyes are sensitive to light, and any noise is intensely annoying. Children become irritable and restless. In severe cases the contraction of the neck muscles sets in early and the head draws back. The back may be rigidly straight or bent back. Muscular pains throughout the body are severe. The muscles may be tremulous or there may be tonic or clonic spasms of arms or legs. With the rigidity of the trunk muscles there may be such extreme contraction of the neck muscles that the back of the head lies between the shoulder-blades. General convulsions are not common except in childhood. Strabismus is a common symptom. Paralysis of eye and face muscles is not uncommon, though paralysis of trunk muscles is rare.

Of sensory symptoms, headache is the most persistent and constant. It is chiefly in the back of the head, radiating into the neck and back. The spine may be extremely sensitive, and general hyperesthesia may exist.

Delirium of a wild and maniacal type may occur, but is not usually so pronounced. Marked erotic symptoms are sometimes seen at the beginning. In a few days the delirium, with the advance of the exudate, gives way to stupor and this again to coma.

The temperature is irregular and variable. There are frequent remissions, and no constant or regular curve of temperature can be laid out. Sometimes the fever is slight or wanting. In other cases it may reach 105° or before death 108° (Osler). A personal case showed 110° immediately before death.

The pulse in children may be very rapid; in adults it is generally full and strong. It may be slowed to 50 or 60 in the minute. Cheyne-Stokes respiration and sighing are sometimes seen, but in the absence of pneumonia, respiration is not usually much quickened.

The skin manifestations are important. Herpes is almost as constant as in pneumonia. The petechial rash which has given the disease the name of spotted fever, is not always present, varying in frequency in different epidemics. In 35 to 40 per cent of the cases there is none or it is negligible; in other cases the whole body may be covered. An erythema or dusky mottling is sometimes present, or there may be rose spots like those of typhoid. Urticaria, erythema nodosum, ecthyma, pemphigus and gangrene of the skin are rarities.

The leucocytosis is massive, from 25,000 to 40,000 per C. M. It persists as long as the disease lasts, no matter how chronic it may become.

The vomiting noted as an initial symptom sometimes persists, and may be the most annoying feature of the illness. Ordinarily it soon subsides and gives no trouble. The bowels are usually constipated, and the reverse condition is rare. The spleen is rather constantly enlarged.

The urine may be albuminous or increased in quantity. Sugar is sometimes noted, and in malignant types, blood.

Course.—The course of the disease varies between a few hours and several months. More than half of the deaths occur in the first 5 days. In favorable cases the symptoms after persisting for 5 or 6 days gradually lessen, the spasm improving, the fever droppining and the delirium waning. Sudden drops in the temperature are of grave import. Convalescence is tedious and protracted. Complications and sequelæ are frequent and troublesome.

Abortive Type.—The attack sets in with great severity, but the symptoms ameliorate after a day or two, and improvement is rapid. It is not to be confounded with ambulant mild cases, where the difference is of degree and not of time, which latter cases are ordi-

narily only to be recognized as meningitis in the presence of an epidemic.

Intermittent Type.—This has been observed in many epidemics and shows a temperature curve like that of malarial intermittent or remittent fever, with daily or tertian exacerbations, or more frequently like the intermissions or remissions of pyemia.

Chronic Form.—This form is fairly frequent. The attack is protracted from 2 to 6 months, and there may be the most pronounced wasting of the body. In a portion of these cases chronic hydrocephalus or brain abscess is probably present. It differs distinctly from the intermittent type.

Complications.—*Pneumonia* has already been mentioned as a common associate of cerebrospinal fever, and in some cases it is difficult or impossible to say which is the primary condition. In some cases true pneumonia caused by the pneumococcus is associated with this disease; in others, they are two phases of one infection.

Joint inflammations are common in some epidemics.

Pleurisy, pericarditis, and *parotitis* are not rare.

Paralysis temporary or permanent, of various cranial nerves or groups of muscles occurs. This may be due at times to an accompanying peripheral neuritis.

Headache may be persistent for years after an attack.

Chronic hydrocephalus sometimes occurs in children.

Aphasia and *feeble-mind* are occasionally observed.

Special Senses.—Eye.—Inflammation of the optic nerve may be caused by involvement in the exudate at the base of the brain. One series of 40 cases showed 6 instances of involvement of the optic nerve. The inflammation may also extend into the ball, causing purulent irido-choroiditis and loss of the eye by bursting. When the fifth nerve is involved, corneal inflammation and ulceration frequently follow.

Ear.—Labyrinthine involvement often causes deafness. Middle ear and mastoid abscesses occur by direct extension. 55 per cent of a series of recovered cases were deaf. It is suggested that the abortive form may be responsible for much early acquired deafness of unknown origin.

Nose.—Strümpell suggests that the frequently observed coryza present at the beginning of the disease may be the first stage of

the infection. This is also borne out by Flexner's experiments already noticed.

Diagnosis.—Stokes's maxim must be borne in mind, that "there is no single nervous symptom which may not and does not occur independently of any appreciable lesion of the brain or spinal cord."

The principal symptoms have already been mentioned, and taken as a whole, make a fairly characteristic picture.

KERNIG'S SIGN.—This is present in all forms of meningitis. If the thigh is flexed to a right angle on the body, the knee cannot be straightened if there be meningitis.

LUMBAR PUNCTURE.—This is a harmless procedure, which is made with a small aspirator or antitoxin needle with slightly blunted point and edges. A spinal anesthesia needle of irido-platinum is preferable. It can be done without general anesthesia as a rule, by the use of the ethyl chloride spray, but in children a few breaths of chloroform or ethyl chloride make it entirely painless. The patient is turned on the right side, with the knees drawn up, the back bowed, and the left shoulder forward.

The spinous processes are identified by touch, and the needle entered to the side of the median line, thrusting upward and inward into the third lumbar interspace to a depth, in infants of about 1 inch, and in adults nearly 2 inches. It is needless to say that this must be done under the strictest aseptic precautions. The skin is most easily and completely sterilized by painting with iodine, without previous washing, until a dark brown color results. The needle should be carefully boiled, or if of irido-platinum, may be heated to redness. After concluding the operation the puncture should be sealed with collodion.

The fluid runs usually drop by drop, and is generally turbid, but may be bloody or rarely clear, in the presence of meningitis. The pressure reaches sometimes as high as 250-300 millimeters of mercury, the normal being about 120 mm.

Cultures should be prepared, and coverslip preparations made and studied at once. Centrifugalization of the fluid may aid in concentrating the cells and bacterial flora so that diagnosis is easier, but it can frequently be made from the unsedimented fluid by the aid of the stained coverslip preparations. There is usually no difficulty in distinguishing between the pneumococcus and the intracellularis. Should no organisms be found, and tuberculosis be suspected, a guinea-pig should be inoculated.

Prognosis.—The mortality ranges in different epidemics from 20 per cent to 75 per cent, unless the Flexner serum is used, when the mortality is much reduced. This serum is not at present to be had commercially, but the Rockefeller Institute has arranged for a supply to be kept in competent hands at most of the large cities. The health officer should know to whom to apply in order to secure for the sick the benefits of this treatment, and on the outbreak of an epidemic or the occurrence of a sporadic case, should arrange to avail himself of it. It is used by withdrawing an amount of the cerebrospinal fluid (50 c.c. for an adult), and injecting a less amount of the serum (30 c.c.).

Diphtheria antitoxin has apparently been of benefit in some epidemics.

The Flexner serum is valuable not only for the reduction of the death-rate, but prevents in many instances the deplorable sequelæ which are really worse than death.

Prophylaxis.—No certain methods are yet available. All bodily discharges and especially those from the nose and throat should be thoroughly disinfected. The quarantine should last at least 14 days from the first appearance of the disease, and should be continued till the patient has recovered. Disappearance of the diplococci from the nasal secretion for several successive days might form the period for release from quarantine. Carriers should be sought for as in diphtheria, and if found, isolated until the disappearance of the germ.

Disinfection.—Formaldehyd fumigation for 6 hours.

CHAPTER XV.

THE VENEREAL GROUP.

This is a group of four diseases, of which but two will be considered. The third member of the group, chancroid, is omitted because it is not a constitutional disease nor one of sociological importance, and because the same measures which avail to prevent the two which are here considered will also prevent chancroid. The fourth disease is *Frambesia* or *Yaws,* a spirillar disease due to the *Spirochæta* (*Treponema*) *pertenuis* and is somewhat similar to syphilis, being sometimes propagated through sexual intercourse and sometimes through innocent inoculation. It is exclusively a disease of the tropics, and there seems to be but little chance of its establishment in this country. Should it ever be introduced, the same means employed to limit or prevent syphilis will be found efficacious.

The two diseases considered in this chapter are of very great sociological importance, since both in different ways tend to crowd the charitable institutions with invalids and blind, and both increase the number of sterile women and sterile men. For this reason, the venereal diseases are worthy of our most earnest study as sanitarians and our best efforts to limit or end their ravages. Unfortunately a foolish prudery, which now bids fair to be in some degree dissipated, has prevailed in regard to them. The campaign against venereal disease has been left too largely to well-meaning but poorly informed lay fanatics, while the sanitarians and medical and lay sociologists have avoided the subject.

These two diseases are to be fought by stirring up moral sentiment against them, but it must not for a moment be forgotten that the sexual appetite is the most dominant of all the calls of instinct except hunger, and that when all that can be done in the way of education has been accomplished, there remains a residue that in our present state of society must be protected against, in order that the innocent may be defended. Therefore as sanitarians, having done all we can on moral grounds, we must endeavor

to afford physical protection, in order that the weak and erring may be protected against themselves, and not make themselves or their children burdens on society.

SYPHILIS.

Definition.—A specific disease of slow evolution, caused by the *Spirochæta (Treponema) pallida,* propagated by inoculation (acquired syphilis) or by hereditary transmission (congenital syphilis). (Osler.) The morphological status of the pale spirochæte is not definitely established, different authors classifying it as a bacterium and as a protozoön. On chemical grounds the latter seem to have the best of the argument, however, since the organic arsenic compounds are highly effective against the spirochæte and many parasitic protozoa, but are ineffective against all known bacteria.

Etiology.—The disease is normally propagated by sexual contact, but may be acquired by kissing, by unclean instruments of dentist or surgeon, by surgeons and nurses in the discharge of their professional duties and by intrauterine infection, as well as in less common ways.

Incubation.—The primary sore usually appears after a period of 3 to 4 weeks has elapsed after the infection.

Symptoms.—Syphilis is so varied in its symptomatology that for a proper description the reader is referred to any of the standard works on the subject, space forbidding its proper consideration here. Only those symptoms, accompaniments and sequelæ will be noted which possess sociological or sanitary importance:

(a) The primary sore and mucous lesions are important as being the ordinary lesions which propagate the disease.

(b) The eye is affected with iritis, irido-cyclitis and retinitis, causing blindness or impairment of vision, and the punctate keratitis of hereditary syphilis is equally effectual in the same direction by rendering the cornea hazy or opaque.

(c) Sclerotic changes take place in the ear, notably in the labyrinth, which cause hopeless deafness.

(d) Endoarteritis causes the arteries to lose their vitality and elasticity and by yielding to the blood-pressure aneurisms are formed and cerebral and spinal hemorrhages result.

(e) The central nervous system is affected by sclerotic changes which result in the various progressive paralyses and locomotor

ataxia. Gummatous tumors may cause death or prolonged and disqualifying paralyses.

(f) The peripheral nerves may become the seat of chronic inflammation resulting in long invalidism.

(g) Most important to the sociologist is the great tendency of pregnant syphilitic women to abort, and if the offspring should be carried to term, to have it still-born or perish in infancy, or if it should live, to have it attacked by some of the noncomitants noted above.

Diagnosis.—Where this cannot be made by the history or symptoms, it is sometimes possible by the serum reactions of Wassermann and Noguchi, described in Part III, page 361.

Prognosis.—The sanitarian should never forget that with a chronic disease such as syphilis, intelligent treatment is a public as well as a private duty, and should urge all syphilitics to avail themselves of the best treatment available. Modern therapeutics have largely divested syphilis of its danger to life, and the prognosis should therefore be always as favorable as possible as to ultimate recovery, provided the patient submits to proper treatment. The employment of hypodermic medication by arsenical and mercurial compounds, by shortening the time required for treatment and increasing its efficiency is not only a private but a public service, as shortening the infective period.

Prophylaxis.—The prophylaxis of syphilis will be considered with that of gonorrhea.

GONORRHEA.

Definition.—An acute contagious disease of mucous and serous membranes due to infection with the gonococcus, and usually propagated by sexual contact.

Symptoms.—From 3 to 10 days, occasionally longer, after an impure intercourse, the meatus urinarius in either sex is attacked by a burning itching sensation, worse on urinating, and on examination the lips are found to be stuck together. The discomfort increases, the discharge becomes more profuse and after 2 or 3 days is thick and creamy from the male urethra and the female vagina. After 10 days or 2 weeks, the discharge usually becomes more watery and the acuter symptoms are somewhat relieved. There is always a tendency for the invasion of the deeper structures, causing a part of the complications hereafter to be mentioned:

A. In the Male.

(a) Stricture of the urethra, which frequently results in chronic invalidism.
(b) Prostatitis, with like sequelæ.
(c) Epididymitis, with sterility.

B. In the Female.

(a) Endometritis and salpingitis, with attendant invalidism and sterility.
(b) Ophthalmia neonatorum in the offspring.

C. In Both Sexes.

(a) Gonorrheal rheumatism (arthritis) a very disabling complication.
(b) Gonorrheal endocarditis, a very serious and often fatal complication.
(c) Gonorrheal conjunctivitis (see Chapter XVII), a lesion frequently resulting in partial or total blindness.

Unclean hands or towels may convey the virus to the eyes of the patient or others, and in institutions may cause almost every child to be attacked by conjunctivitis or gonorrhea of the genitalia. *Those having the disease or caring for it in others must invariably disinfect the hands at once.*

THE GENERAL PROPHYLAXIS OF VENEREAL DISEASE.

The sociological importance of venereal disease has already been dwelt upon at some length. It goes far to justify strenuous measures to abate these "Black Plagues." Certain measures have been tried and found wanting. Among others, the inspection of prostitutes and their segregation into districts under police supervision have been tried in many places, and after trial abandoned. The reason for this is the fact that the publicly known prostitute is not the greatest danger, but the clandestine prostitute who plies her trade in dark corners, under constant fear of detection. The public prostitute, who has been instructed in her business, values her clientele, and insists on a rough and ready examination of her prospective customer which will reveal at least the grosser lesions of venereal disease, and after intercourse provides him with toilet requisites including antiseptics and insists on their use, sometimes applying them herself. The clandestine prostitute has not usually the facilities for her own protection nor that of her client.

The first step which should be insisted on is to make these diseases reportable, the records being kept wholly confidential. It is just as important that syphilis and gonorrhea be reported as that smallpox should be—indeed more so, for they are more widespread and

in the aggregate vastly more fatal. Genitourinary hospitals and wards should be enlarged, and those affected urged or forced to enter them if they cannot be properly cared for in their homes. The stigma of venereal disease should be removed from syphilis especially, and the fact made widely known that it is very frequently indeed innocently contracted. Disorderly houses known to harbor infected women should be placarded with the words "Contagious Disease," a method which is very effective in inducing these women to enter hospitals which afford them not only physical cure but a chance for moral rehabilitation. Physical examinations should be made at frequent but irregular intervals, swabs being made from the cervix uteri and urethra and planted on appropriate culture media. In the event of a positive result being found, the inmate is given the choice of entering the hospital or causing the house to be placarded, which invariably causes her to select the former alternative. These means are effective against only a part of the infected population, but reduce the number by that much. Certificates of non-infection should never be given, either to those who are discharged from the hospitals or inmates of houses, but infected women should never be discharged from treatment with active disease, being held under threat of police court action, if necessary.

No opportunity should ever be let pass to point out the multiform dangers of impure sexual intercourse. The greater the public knowledge on the subject, the less likely the danger of contracting these dangerous diseases. It should always be insisted on that they are never trifling matters, and that of the two, syphilis is less dangerous to life. But if the man is obdurate, he should be instructed to use the methods now in use in the military services which have greatly reduced the amount of venereal infection:

1. A 1:1000 bichloride solution or a 1:500 permanganate solution is used to cleanse the parts.

2. An ointment of 10 per cent argyrol in lanolin is injected into the urethra.

3. 20 grains of a 33 per cent calomel ointment made with a lanolin base is rubbed over the parts.

If this prophylactic treatment is well applied, the danger of venereal infection is minimized. Packets containing these antiseptics in convenient form are now put up by several houses.

With the woman, the above treatment cannot be used. She is

therefore forced to depend on the bichloride or permanganate applied by douche, or better, by a pledget of absorbent cotton.

The advocacy of such measures as the above-mentioned prophylactics does not lose sight of the moral aspects of the case, nor condone the immorality. For the public good it endeavors to prevent or minimize the ill effects of the sins it cannot abolish. In the end public opinion will be led to support all measures for the suppression of venereal disease as it now does in large measure those for the prevention of tuberculosis, yet only twenty years ago the present status of antituberculosis work seemed as remote and Utopian as at present seem efforts for preventing venereal disease. The sanitarian must lead in the work, as his training and bent of mind naturally fit him to do.

CHAPTER XVI.

THE RINGWORM GROUP.

The infectious diseases of the skin do not form a very large or important part of the health officer's work, but to the institutional physician and the school inspector they are sometimes sources of much worry.

Of the diseases here considered, one is of unknown etiology and four are diseases caused by fungi somewhat allied to the moulds. Common itch (scabies) and the skin irritations caused by lice are discussed in Chapter XVIII, as is the "ground itch" by which the hookworm gains entrance to the body.

IMPETIGO CONTAGIOSA.

This is a disease most frequently found in children but sometimes seen in adults. It may appear in epidemic form or sporadically. It affects the poorly nourished and badly fed rather oftener than the strong and well, but no class is entirely exempt. The etiology is unknown.

Symptoms.—The eruption begins as small vesicles, which spread, form pustules, and later dry and form crusts. It may occur on any part of the body, but is more common on the face and hands. There is not much itching, and but slight constitutional disturbance or none. If properly treated, it should be well in ten days.

There should be no difficulty in differentiating this disease from smallpox, but the differential diagnosis from all the exanthemata will be found on page 81.

Isolation.—The subjects of impetigo contagiosa should be excluded from school, and if inmates of institutions should be isolated till the skin has been entirely clear for several days.

TINEA.

There are three forms of fungi which cause the diseases known as tinea: *tinea trichophytina*, which is subdivided into *tinea tonsurans*, ringworm of the scalp or "scaldhead" and *tinea circinata*,

which is more usually called ringworm by the laity; *tinea favosa,* favus; tinea versicolor.

RINGWORM OR BARBER'S ITCH.

Ringworm or barber's itch, as it is called when it affects the bearded part of the face, is due to a microscopic fungus known as *Trichophyton tonsurans.* The specific name is derived from the fact that the growth of the fungus in and around the hair follicles causes the hair to fall out permanently. It affects the hairy scalp only in children, but in men the bearded portion of the face is often attacked. In the circinate form it may appear on any part of the body and the lesions may be multiple.

Mode of Infection.—This fungus is carried on unclean hands, towels, razors or toilet articles. For this reason the sanitation of barber-shops is a matter for some concern. While the disease is not a serious one so far as danger to life is concerned, it may very considerably disfigure.

Isolation.—Children in school should be excluded until the lesions are entirely well; in institutions they should be isolated.

FAVUS.

This disease is caused by the growth of the *Achorion schoenleinii.* It appears in the form of small yellow cup-shaped crusts, which have a "mousey" odor. It appears on almost any part of the body, but affects the scalp by preference. These crusts may become confluent, covering large areas with a thick scab. The disease is much more difficult to handle than ringworm. Isolation is the same as for that disease.

TINEA VERSICOLOR.

This is caused by the *Microsporon furfur* and manifests itself by fine yellowish scales, usually situated on the trunk. The isolation is as for the two preceding.

DHOBIE ITCH.

This term is a sort of catchall for a number of skin diseases of diverse etiology, but having for their common symptoms an intensely itching dermatitis. It is a disease of the tropics, and can often be seen on returning soldiers. The state of California takes cognizance of it, making it a reportable disease. In military prac-

tice, where it is most common, it is not isolated, but care is exercised to prevent contagion, either mediate or direct. The exciting cause is probably an infection by one or more of the fungi described under *tinea* and by related organisms. The disease in the tropics is rather inveterate, coming out particularly on those parts of the body which are apt to be irritated by the clothing. The scars left by the dermatitis are apt to be pigmented.

CHAPTER XVII.

THE CONJUNCTIVITIS GROUP.

These diseases are of the gravest importance to the public, since loss of sight is not only a calamity to the individual, but a loss to society in that an actual or potential wage-earner is deprived of the opportunity to make a living, and is thrown as a burden on his family or the municipality.

Therefore, the health officer is in duty bound to aid in every way the suppression of the spread of infectious eye-diseases, resorting if need be to drastic measures of quarantine under the general authority of his commission in the absence of specific legislation.

TRACHOMA.

Synonyms.—Granular Conjunctivitis; Egyptian Ophthalmia; Military Ophthalmia.

Definition.—An infectious disease of the eye, chronic in type, characterized by small oval masses in the palpebral conjunctiva, and by secondary changes in lids, conjunctiva and globe.

Onset.—There are three forms of onset:

1. The granules develop without discomfort, there being little mucous secretion, only slight lacrymation, and slight thickening of the lids. The ocular conjunctiva is not reddened and the cornea is not involved.

2. The common form of onset. There is pain in the eyelids which feel hot and rough to the patient. The irritation, lacrymation, and after a few days the mucopurulent secretion, are much more than in the first form. On turning the lids, the conjunctiva is found to be much reddened and thickened, and after 2 to 4 weeks from the beginning, granules may be seen over the tarsal cartilages and sometimes further back. The swelling of the conjunctiva may be enough to mask the granules, and they may become visible only after the acute condition has subsided. The glands in front of the ear are enlarged.

3. This form is fortunately uncommon, but is seen in young and

middle-aged adults. The onset is rapid, with burning and scratching of the lids, and after a day or two there is a marked lacrymation, followed by a mucopurulent or even bloody discharge. The conjunctiva is hypertrophied and the granules are confluent. The ball is much injected and corneal involvement begins early. The preauricular glands and even the submaxillary lymphatics may be swollen.

Second Stage.—After the first stage has lasted from 6 weeks to a year, the second stage begins, with the coalescence of the granules which then go on to cicatrization. The cul-de-sacs of the conjunctiva become shallow, the tarsal cartilages shorter, narrower and more curved. The corneal epithelium is destroyed by the rubbing of the roughened lids. Vascular pannus destroys the clearness of the cornea forever. Secondary infections become engrafted, the eyelids are turned in by the contraction of the scars and the lashes rub the balls.

Third Stage.—After years of the second stage, the third stage appears. The cornea is entirely opaque and only light perception remains. The conjunctiva is entirely destroyed and the area formerly occupied by it much contracted. The cornea is dry and harsh, and pale in color.

Isolation.—Isolation must be enforced, and the utmost care taken that all towels and toilet articles used by the patient are disinfected. Attendants must thoroughly disinfect their hands by one of the standard methods. This disease is an absolute bar to entrance into the United States by prospective immigrants.

MUCOPURULENT CONJUNCTIVITIS.

Two forms of micro-organism, the Koch-Weeks bacillus and the Morax-Axenfeld bacillus, cause somewhat differing forms of mucopurulent conjunctivitis. Both forms are characterized by lacrymation and the presence of mucus and pus in the eyes. Children having them should be excluded from school and isolated if in institutions. Care should be taken that they are not transmitted by unclean hands, towels, or basins.

GONORRHEAL CONJUNCTIVITIS.

This dangerous disease is due to infection with the *gonococcus*.

Incubation.—24 to 36 hours.

Acute Stage.—For the first 24 hours the eyes are reddened and

the flow of tears increased; as the period draws to a close the lids are much swollen and injected and the secretion becomes muco-purulent, sometimes bloody and always mixed with the tears. The eyes burn and feel gritty to the patient, and pain is felt in the ball on pressure. In 48 to 72 hours longer, the height of the inflammation is reached; the swelling of the lids is enormous, the patient being unable to open the lids and the surgeon able to do so only with difficulty. The conjunctiva of the lids is thickened and velvety, while that of the balls is swollen. Chemosis is marked and ecchymoses appear here and there on the ball. The pus is yellow, thin, and streams from the eyes.

Subacute Stage.—After 5 to 8 days the swelling of the lids subsides and the venous congestion disappears. The pain moderates, and after 2 or 3 weeks convalescence may be established, or a chronic condition lasting for months may supervene.

Complications.—About one-third of the cases have involvement of the cornea with varying results. Complete restoration may occur or there may be sloughing with entire loss of vision. Iritis, irido-choroiditis, or panophthalmitis, with loss of the eye, may also occur.

Prophylaxis.—All patients having gonorrhea or gleet must be warned of this danger. The disease is carried like other forms of conjunctivitis and the same measures are effective in its prevention.

OPHTHALMIA NEONATORUM.

This very dangerous disease is a purulent conjunctivitis due usually to the *gonococcus,* but sometimes to other pus organisms, which is contracted generally during birth, but more rarely *in utero.* It begins ordinarily on the second day after birth, but sometimes a few days later. It is similar in evolution to gonorrheal conjunctivitis and its spread to others is to be prevented in the same way. Its prevention in the new-born is a matter of the greatest simplicity, being simply a cleansing of the eyes with a physiological salt solution, a saturated solution of boric acid, or merely boiled water, *immediately* after birth, and the instillation into each eye of 1 or 2 drops of silver nitrate solution, 2 per cent (10 grains to the ounce). This must never be omitted, even in the case of those who are presumably free from infection, because its omission tends to make the use of the solution invidious when really required.

Many states require ophthalmia neonatorum to be reported, and

some require a notation on the birth certificate that the necessary precautions have been taken. Since a very high percentage of the hopeless blindness of children, variously estimated at from 80 to 90 per cent is caused by this disease, no precautions are too strict. The sanitarian should fulfill his duty by seeing that all such regulations are enforced.

CHAPTER XVIII.

THE ANIMAL PARASITES.

Very many species of animals above the protozoa, which are treated separately, are parasitic in man. Only those will be here mentioned which are found in the United States, and are either known to be pathogenic in themselves or capable of acting as disease carriers. The space which can be allotted to this subject is insufficient to allow more than the most cursory review of the subject.[1]

FLUKES.

Paragonimus (Distoma) Westermanni.—This worm is the cause of a peculiar lung disease, characterized by a chronic cough, with rusty sputum and occasional hemorrhages, usually light but sometimes severe. The parasite is 8 to 16 mm. in length, with a breadth of half the length, is a native of the eastern coast of Asia, and is sometimes imported into the United States. It is probably also a native infection of the cat, dog and hog in this country, and the method by which man is infected is not known. The ova of the fluke are to be found in the sputum and their presence verifies the diagnosis.

Fasciolidæ (The Liver Flukes).—Five species belonging to this family and representing three distinct genera are known to occur in man, and probably all of them are to be found in this country, either by original infection or importation.

Symptoms.—There is an irregular, intermittent diarrhea, usually with blood. The liver gradually enlarges, with pain and intermittent jaundice. There is little fever. After 2 or 3 years, both ascites and anasarca come on, with anemia and persistent diarrhea. Apparent recovery may take place, but relapse occurs and the patient dies.

This is a disease which tends to attack all the members of a family,

[1] The reader who wishes to study these parasites exhaustively is referred particularly to Tyson, whose well illustrated chapter on the subject includes not only clinical but full zoölogical data.

and particularly the young children. For this reason it is well to suspect transmission of the ova, which abound in the stools, on dirty hands. In cases which have developed, nothing can be done except to see that, by proper care of the stools and persons, it is not transmitted to others.

TAPE-WORMS.

The tape-worms have a two-cycle existence, the adult stage being passed in man, and the other in the body of an intermediate host. The two commonest forms in this country are the pork tape-worm, *Tænia solium*, and the beef tape-worm, *Tænia mediocanellata.* A description of these species will be omitted here since they are familiar to all, but attention is called to the immature forms, the *cysticerci,* bladder-worms or measles, dead-white opaque sacs one-fourth to one-half inch in diameter, seen in the muscle and other parts of beef and pork carcasses. Carcasses containing them should be condemned, unless thorough cooking can be assured. Properly cooked, there is no objection to their use.

Another tape-worm, *Bothryocephalus latus,* the broad or fish tape-worm, formerly supposed to be confined to northern Europe, has been found to affect the fish in the Great Lakes which were apparently infected through sewage containing ova from the stools of immigrants from the originally infected districts. Our present methods of sewage disposal are such as to favor the wide-spread dissemination of this parasite, were it not for the fact that Americans usually do not like underdone fish. Unlike other tape-worms, the *Bothryocephalus* seems at times to cause rather marked symptoms of anemia.

Generalized cysticercus infection may occur, either from ova of any of the above species regurgitated from the small bowel into the stomach in individuals harboring an adult tape-worm, or by an infection from the ova of these or any other of the tape-worms which may have been accidentally swallowed.

ROUNDWORMS.

Five species of roundworms are of importance: the common roundworm (*Ascaris lumbricoides*), the threadworm (*Oxyuris vermicularis*), and the two hookworms (*Ankylostomum duodenale*), the European species, and (*Necator americanus*) the American species, and *Trichina spiralis.*

Fig. 3.

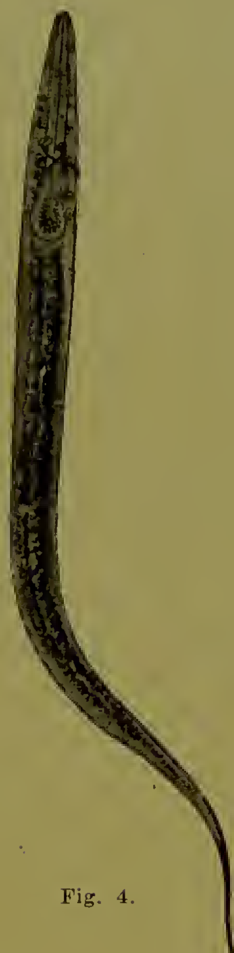

Fig. 4.

Fig. 3.—Male and female hookworms (*Necator americanus*), natural size.

Fig. 4.—Greatly enlarged view of a hookworm shortly after it has been hatched from the egg.

Fig. 5.—Figure of a worm about seven days old. This is the so-called "encysted stage" and is the stage which enters man.

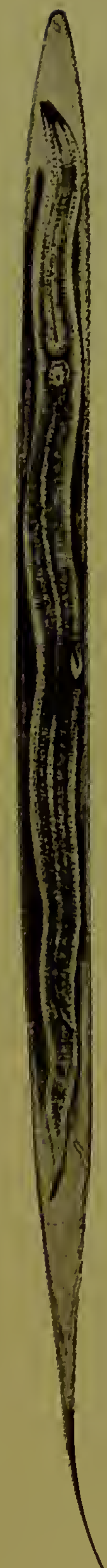

Fig. 5.

The first two of these need no description, as they are familiar even to the laity. There can be but little doubt that the ordinary mode of infection is by the transfer of the ova on unclean hands or by contaminated drinking water. For this reason it is highly important that in all schools facilities should be provided for the children to cleanse their hands after going to the toilet, and their use should be enforced.

The adult trichina lives in the small intestine, where the eggs are deposited, and whence the young make their way immediately after hatching into the voluntary muscles. This process is attended with pain, fever, and marked increase of the eosinophile leucocytes.

Trichinosis is absolutely prevented by cooking all pork until well done. Rats and hogs are the animals most commonly infected, with cats and dogs less frequently. Human trichinosis is more common than is usually supposed, having been found by H. U. Williams, of Buffalo, in 27 out of 505 unselected autopsies, a percentage of 5.3. It is not sufficiently common as a cause of death to appear in the Census reports as a separate item.

The European hookworm is found in the deep mines of California and perhaps in other places, where it has been brought in by miners who have become infected in European mines. The American hookworm is found in all the Southern States, in Cuba, Porto Rico and the Philippines. Both forms have the same general characteristics, the males being one-half inch or a little less in length, and the females about three-fourths inch. The mouth is provided with a heavy armature of sharp teeth by which to lay hold of the intestinal mucosa, and the gullet is a strong suctorial organ by which the blood is drawn out. The eggs are 75 mi. by 40 mi. in the American species and slightly less in the European species.

The mode of infection is peculiar. The feces of an infected person being deposited in a warm, moist place, the eggs hatch out the larval worms, which immediately fasten themselves on the skin of any person exposed to them, and proceed to make their way through the skin and by way of the lymph spaces and perhaps the blood vessels to the intestine. Burrowing through the intestinal wall, they attach themselves to the mucosa, and soon reach the adult stage. Adult worms from one infection may live as long as 10 to 12 years.

The dermatitis caused by the passage of the larvæ through the skin is known in the South as "ground itch," "dew itch," "toe

itch" and so on. It is best prevented, together with the subsequent hookworm infection, by wearing shoes, since the larvæ are unable to make their way through the leather.

The **symptoms** of hookworm are varied and serious. The skin is dry and there is an absence of perspiration; the color is tallowy, and from a waxy white to a dirty yellow. The hair is dry, coarse, and often scanty, especially on the body. The expression is stupid, often so markedly as to permit a tentative diagnosis on that fact alone. The abdomen is swollen and prominent, the appetite capricious and often there is a morbid desire to eat the most unnatural things—clay, chalk, woolen cloth and the like. Blood may or may not be found in the stools. The most characteristic as well as the gravest symptom is the anemia, which is often profound, the red cells running sometimes as low as 754,000, and in other cases the hemoglobin has been reported as low as 8 per cent. In the usual run of severe cases the red cells and hemoglobin will be reduced not far from 50 per cent on the average. The urinary and reproductive systems of the patient suffer severely. Menstruation is established late, sometimes as late as 20, is infrequent and scanty when it does occur. In the male, sterility and impotence are not uncommon, and in the female, miscarriage, still-birth and sterility are very usual.

The age of the patients with ankylostomiasis is greater than that of those with American hookworm disease, as the former is an occupational disease of miners and clay-workers, while the latter is a disease of the open country, to which children on account of the habit of going barefoot are more exposed than adults. Stiles' 1,470 cases show nearly 60 per cent under 18. The following very clear directions for diagnosis, prophylaxis and treatment are from Stiles.[1]

Hookworm Disease.

Diagnosis.—There are three methods of diagnosing hookworm disease—namely, by microscopic examination of the fecal material to find the eggs; by judging the symptoms; and by experimental treatment and finding the expelled worms in the stools.

Microscopic Examination of feces.—It is rare that the adult worms are seen in the discharges except during treatment, but the stools of hookworm cases contain the characteristic eggs of the parasite, and by finding these eggs a positive diagnosis can easily be made. The Southern state boards of

[1] Hookworm Disease (or Ground-itch Anemia). Public Health Bulletin No. 32, Public Health and Marine Hospital Service. Washington, Government Printing Office, 1910.

Health and the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service are making this examination free of charge.

Ordinary technique.—For ordinary purposes the following technique is sufficient: Patients are instructed to furnish about half an ounce of their fresh fecal material. A small portion of this is taken up on the flat end of a toothpick (using a separate toothpick for each specimen) and smeared on a slide in a drop of water (personally I prefer the 2 by 3 inch rather than the 1 by 3 inch slide; and in hot weather or when the feces are especially offensive, trikresol is better than water); the smear should be uniform and not too thick; no staining or drying is necessary; a cover glass (1 inch square is a good size) is placed over the smear, fluid is added under the cover if necessary, or drained off in case too much is present, and the preparation is examined under an 8-millimeter (or one-third inch) objective. A mechanical stage is unnecessary. The manipulation of the slide is rendered easier if it is held lengthwise (if a 1 by 3 slide is used) rather than otherwise. In heavy infections the eggs will usually be found on the first slide, but at least ten such preparations should be examined before a negative opinion is expressed. It takes about thirty to sixty minutes to examine ten such slides properly.

Usually eggs will be found in fresh feces in the 4 to 8 cell stage (fig. 6). If in perfectly fresh specimens eggs are found in the 32-cell stage there is a chance that another parasite (*Trichostrongylus*) is present.

If free embryos are present in the fresh feces the probability is that the Cochin China worm (*Strongyloides stercoralis*) is present.

The mouth cavity of the hookworm embryo is about as long as the diameter of the embryo at the posterior end of mouth cavity; in the embryo of *Strongyloides* the mouth cavity is only about half as long as the diameter of the embryo at the posterior end of the mouth cavity.

If pressure is exerted on the slide, the outer covering of *Ascaris* eggs may rupture, and the beginner might possibly confuse these with hookworm eggs. The beginner in this work may also be confused by various vegetable cells found in the specimen, which he mistakes for eggs, or by plant hairs, which he mistakes for embryos. Strawberry hairs, especially, are mistaken for hookworms by persons not familiar with this class of work.

Diagnosis by symptoms.—The recognition of well-marked cases on basis of symptoms presents very little difficulty to one who is thoroughly familiar with this disease, but in general for every case so recognized, one to several cases will be in doubt or will entirely escape the clinician who may depend entirely on symptomatology.

Given a patient in the area of infection, with dry hair, dry skin, dilated pupil or with unusual tendency to dilatation, with tenderness in the epigastric region, continuing toward the right but with a tendency to disappear toward the left, with winged shoulder blades, shoulders sloping down and forward, slow of speech, tallow-like skin, poorly developed in general, anemia, scant pubic and axillary hair, a delayed type of menstruation, and a history of ground itch, especially if several such persons exist in the same family, and diagnosis is practically positive.

Diagnosis by experimental treatment.—As the state boards of health are making diagnoses free of charge, there is little if any reason for not having a microscopic examination made. At the same time the practical difficulty

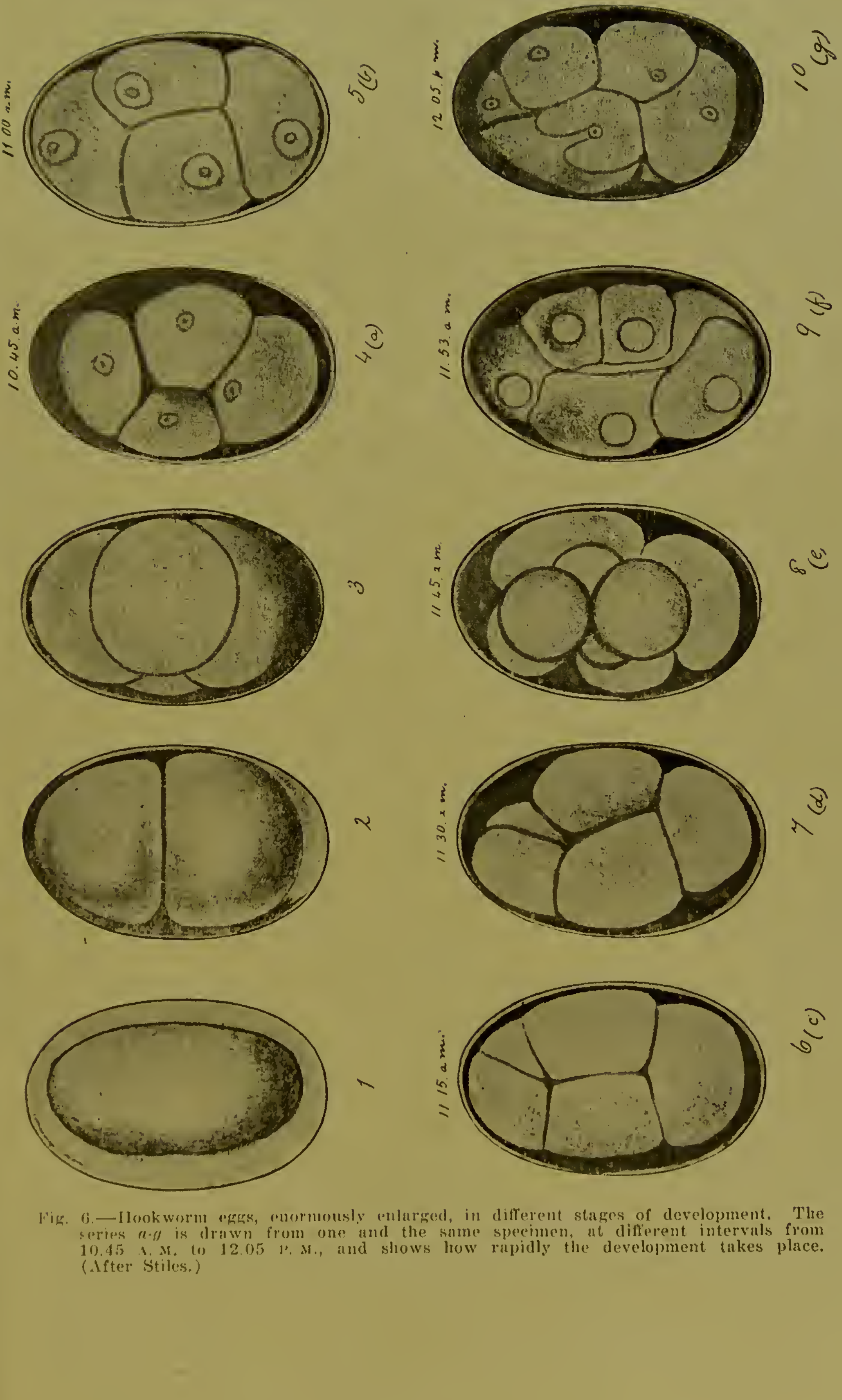

Fig. 6.—Hookworm eggs, enormously enlarged, in different stages of development. The series *a-g* is drawn from one and the same specimen, at different intervals from 10.45 A. M. to 12.05 P. M., and shows how rapidly the development takes place. (After Stiles.)

must be frequently faced that many rural people who have no objection to a microscopic examination of their sputum and urine do object very decidedly to furnishing samples of their stools. This may appear incomprehensible, but it is a factor which must be squarely faced. Again, in remote rural regions it is often impracticable to make several trips to the house to obtain a stool, and it is often impossible to induce the patient's family to take the trouble of sending a stool to the physician. In such cases almost the only plan to follow is to institute an experimental treatment and see if hookworms are passed.

Treatment.—The fundamental principle underlying the treatment of hookworm disease is the same as that which underlies the treatment of all other zoöparasitic diseases, namely, first treat the parasite, not the patient. After the parasite is treated, attention may be directed to treating the patient.

Although hookworm disease may occur in persons in any walk of life, it is particularly among the poorer classes that it is found, and the average hookworm patient (children excepted, to a certain extent) can not afford to lose several days' wages to undergo treatment. It is therefore frequently expedient to conduct the treatment Saturday evening and Sunday morning. It will often be found difficult to arouse the interest of a community in regard to the presence of hookworm disease and the need of treatment. This can frequently be done, however, if it is borne in mind that the resulting anemia is, in common with other anemias, a frequent cause of amenorrhea.

WARNING.—Recalling that primarily we are to treat the parasite, not the patient, it should be remembered that if too great a quantity of thymol is absorbed by the patient, alarming symptoms and even death may occur. Accordingly, the patient and the patient's family should be carefully warned not to permit the patient under any circumstances to have on the Sunday during which the treatment is given any food or drink containing alcohol, fats, or oil. Patent medicines should be mentioned in particular, because of the alcohol many of them contain, and even milk and butter should be forbidden. I know of one case of serious thymol poisoning which followed promptly after the patient took a copious drink of milk the day thymol was taken.

PRELIMINARY TREATMENT.—On Saturday evening give a dose of Epsom salts. The reason is this: The hookworms are surrounded by more or less mucus and partially digested food. Unless this is removed, the thymol may not reach the parasites, but may reach the patient, and this is contrary to what is desired, as the thymol is intended for the parasite, not the patient.

THYMOL TREATMENT ON SUNDAY.—(1) *Position of patient:* Instruct the patient to lie on his right side immediately before taking the drug and to remain in that position for at least half an hour after. The reason for this is that many of these patients have enlarged stomachs, and if they lie on their right side, the drug has the benefit of gravity in passing rapidly from the stomach to the intestine; but if any other position is assumed, the drug may remain in the dilated cardiac portion of the stomach for some hours and result in considerable complaint on the part of the patient and delay of the drug in reaching the worms. It is best for the patient to remain in bed until after 10 o'clock (see next paragraph).

(2) *Time of dosage:* The time of giving and size of dose may be arranged on either of two plans, depending on existing conditions.

(a) The plan usually followed is: At 6 a. m., one-half of the total dose of thymol; at 8 a. m., one-half of the total dose of thymol; at 10 [1] a. m., Epsom salts (never castor oil).

(b) If the case is an especially severe one, or if the patient has, upon the first Sunday's treatment, complained of burning or other effects of thymol, the following plan is adopted: At 6 a. m., one-third of the total dose of thymol; at 7 a. m., one-third of the total dose of thymol; at 8 a. m., one-third of the total dose of thymol (if unpleasant symptoms, as a sensation of severe burning in the stomach, have appeared this third dose should be omitted); at 10 [1] a. m., Epsom salts (never castor oil).

(3) *Food:* No food is allowed until after the 10 o'clock dose of Epsom salts, but the patient is permitted to take a glass or so of water after the thymol, if he desires.

(4) *Thymol:* Finely powdered thymol in capsules, preferably in 5-grain capsules, should be used. A recently proposed modification in the dispensing of the drug promises excellent results; this is to powder finely the thymol with an equal amount of sugar of milk and to use the flat capsule (cachet) instead of the cylindrical capsule. By this method, the packing of the thymol, sometimes observed when the cylindrical capsule is used, is avoided.

(5) *General rule as to age:* In the table of dosage given in the next paragraph, the maximum dose per day to be adopted as a routine is given for various age groups. In determining the dose, however, the rule should be followed of taking the apparent rather than the real age and of not hesitating to cut down the dose even lower in case of unusually severe cardiac symptoms or other unfavorable conditions. Thus for a boy 16 years old, who appears to be only 12 years old, or in whom the anemia is especially marked, resulting in severe cardiac symptoms, the quantity of thymol should be reduced to the 12 or even the 8-year dose. Some authors give the impression that it is useless to give thymol for this disease unless the full dose is administered. This view is not in harmony with my experience.

(6) *Size of dose:* The following doses represent the maximum [2] amount to be used during one day's treatment for the age groups in question. This is practically the same table that the Porto Rican Commission has been using:

	Grains
Under 5 years old	7½
From 5 to 9 years old	15
From 10 to 14 years old	30
From 15 to 19 years old	45
From 20 to 59 years old	60
Above 60 years old	30 to 45

Total dose, to be divided as indicated in paragraph (2).

[1] Some physicians prefer to allow a longer time (six to eight hours) to elapse between the last dose of thymol and the Epsom salts. If this plan is followed, it is wise to keep the patient under rather close observation.

[2] Some physicians use larger doses, but the doses here given seem to be large enough.

Repetition of treatment.—The foregoing treatment is repeated once a week, preliminary treatment Saturday evening and thymol on Sunday morning, until the patient is discharged.

Duration of treatment.—To recognize whether the parasites are all expelled, and therefore to determine when to end the thymol treatment, either of two plans may be adopted, namely:

(a) *Microscopic examination:* On Saturday morning make 10 microscopic preparations of a fresh stool, or test the stool by the Bass method. If eggs are still present, repeat the treatment; if eggs are not found, discontinue the thymol. It takes about thirty to sixty minutes to make this examination of 10 slides thoroughly.

(b) *Cheese-cloth method:* A much easier way of recognizing the completion of the treatment, and for practical results nearly as satisfactory as the microscopic examination, is the following: Instruct the patient to wash all of his stools Sunday and Monday through a cheese cloth and to keep the cheese cloth moist and bring it to the office on Monday. While the fecal material will wash through, the worms will be retained in the cloth. Continue treatment as long as worms are found in the cheese cloth.

An additional roundworm disease is filariasis, which is an infection with one of three kinds of microscopic worms belonging to the genus *Filaria.* This disease is at present tropical only, but is known to be conveyed by mosquitoes of the genus *Culex,* and may possibly at some future time become naturalized in this country.

ITCH INSECT.

Sarcoptes (*Acarus*) *scabiei,* the Itch insect, is an arachnid insect, parasitic in man, which produces most distressing and troublesome eruptions of the skin. The male is one-fourth mm. in length and one-fifth mm. in breadth. The female is pearly white and can be seen with the naked eye. The insect lives in a burrow a little less than one-half inch in length which it makes for itself in the epidermis. The female lives at the end of this burrow. The male is seldom seen. The favorite sites for its attacks are the folds of skin between the fingers and toes, on the backs of the hands, the axilla and front of the abdomen. The infection may, however, cover practically the whole body.

The lesions are very numerous, and are partly a result of scratching. They are generally papular or vesicular but in children may resemble ecthyma. The burrows may be destroyed by the scratching, but the diagnosis is rarely troublesome.

Children infected with this disease must be excluded from school until entirely well.

Fig. 7.—Bedbug (*Cimex lectularius*): *a*, Adult female, gorged with blood; *b*, same from below; *c*, rudimentary wing pad; *d*, mouth parts; *a*, *b*, much enlarged; *c*, *d*, highly magnified.

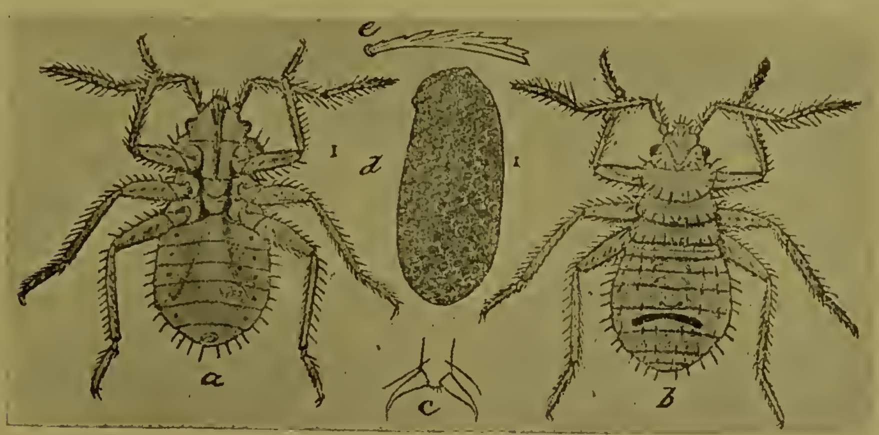

Fig. 8.—Bedbug (*Cimex lectularius*): Egg and newly hatched larva. *a*, larva from below; *b*, larva from above; *c*, claw; *d*, egg; *e*, hair or spine of larva. Greatly enlarged, natural size of larva and egg indicated by hair lines.

Fig. 9.—Bedbug (*Cimex lectularius*): *a*, larval skin shed at first molt; *b*, second larval stage taken immediately after emerging from *a*; *c*, same after first meal, distended with blood. Greatly enlarged.

(From Circular No. 47, Revised Edition, U. S. Dep't of Agriculture.)

TICKS.

These insects are familiar to all and require no description. They are here mentioned for the reason that two varieties of African spirillum fever and the Rocky Mountain tick fever of the American Northwest are known to be carried by them. Determined action has been taken to rid the last named region of ticks, with a view to controlling this fatal and little-understood disease. It should here be noted that the Texas fever of cattle, which is a protozoal infection, was the first disease of either man or animals definitely proved to be insect-borne.

LICE.

Three varieties of lice, the head louse (*Pediculus capitis*), the body louse (*P. corporis*) and the crab louse (*Phthirius pubis*) are parasitic in man. For the head louse, repeated saturations of the hair in coal oil are efficacious. For the body louse, boiling all clothing or exposing it to dry heat for several hours at a temperature just short of scorching is efficacious. A small amount of mercurial or white precipitate ointment applied to the parts of the body where the hair is long, together with a clipping of these hairs if nits adhere to them, will destroy these insects. Pyrethrum ("insect powder") is recommended as harmless and efficient. Crab lice may be destroyed in the same way. Lice are not only annoying in institutional sanitation, but are the only certainly known carriers of typhus and relapsing fevers.

BEDBUGS.

These insects require no description. They are carriers of tropical splenomegaly, and are also suspected of carrying relapsing fever and typhus, although this is not yet proved. They are very annoying in institutions, and are best destroyed by sulphur fumigation, steam sterilization of bedding, and the use of coal oil or corrosive sublimate solution 1 per cent in all cracks and possible breeding places. This may be applied with an atomizer. Iron bedsteads are less apt to afford breeding places for these pests, but may harbor them nevertheless.

FLEAS.

These irritating insects are not true parasites, since they breed in dirt and filth, and attack man and other animals only inciden-

tally. They may be driven off by the use of coal oil on floors, etc., or turpentine and other essential oils, or pyrethrum powder. They may be trapped by putting a small piece of raw meat into a saucer containing a small quantity of coal oil.

Fleas are the ordinary carriers of plague from rodents to man, and it is very likely that otherwise unexplainable cases of ringworm and like parasitic skin diseases are secondary to flea bites.

PART II.

GENERAL SANITATION

CHAPTER XIX.

THE ORGANIZATION OF THE SANITARY SERVICE.

The military ideal is the highest for the sanitary service. It presupposes a responsible head with subordinates, each responsible for his own portion of the work, appointed after searching examination, subject to frequent inspections as to his continuing zeal, ability, and efficiency. Such a body values highest its integrity, its devotion to truth, its courage, its prompt obedience to orders and its good name. Its whole purpose is the faithful performance of study, no matter at what personal cost. These high aims come near to perfect realization in the Public Health Service, and on this model the state and local sanitary services might well be formed.

Such an edifice must be built on four corner stones. First, adequate training. Most of us have had to get our training in sanitation by practising on the community after appointment. Such knowledge, whether acquired in formal instruction or in the school of experience, must be tried on the touchstone of competitive examination, due weight being given to proved ability and experience, in order that the best material may be selected. Zeal and good intentions count for much, but in a highly technical position like that of the sanitarian, the best trained man is none too good.

Second, full time duty. In a few of our larger cities the sanitatarian is already required to relinquish private practice, but in practically none of the smaller places is this so. Health work is not incompatible with other public medical work, provided there is sufficient time for the duties allotted. The British Local Government Board permits health officers to act also as school medical officers, police surgeons, public vaccinators, district medical officers, workhouse and factory surgeons, and superintendents of isolation hos-

pitals. All of these are public or quasi-public positions, and may with propriety be looked after by the sanitarian, but private practice and health work represent too many conflicts to make them a desirable combination, as every experienced health officer knows.

Third, a tenure of office dependent only on the proper discharge of his duties. The care of the people's health is too sacred a thing to be made the football of politics. It should not be possible to remove a sanitarian because he has made some politician put his filthy tenements or his dairy into proper condition. Removal should be predicated only upon charges, properly sustained before a civil service board or a court. Then and then only will the health officer be free to do his duty as he sees it. A corollary to this is the filling of vacancies in the higher grades after due examination and scrutiny of the record of the candidate.

Fourth, a proper remuneration for work that is full of responsibility and sometimes dangerous. If districts are too small to support a man on full time, let them be combined till they are large enough, or let some of the duties mentioned under the second head be attached to the position. Furthermore, a man is willing to accept less money for his work if he feels that it is a place of honor, of secure tenure, and a stepping-stone to a better. There are few counties in the older settled portions of the country which could not by a *per capita* appropriation of 25 cents, secure the entire time of an excellent sanitarian, pay for his clerical and outside assistance, his traveling expenses and all expenses of quarantine, disinfection, laboratory supplies and office expenses, with a balance in the treasury at the end of the year.

Such a plan is not chimerical, since it is in use in Hawaii, the Philippines, in many of the larger cities of this country, and in practically all of Europe except Russia and Turkey. The great difficulty is that Americans are willing to do for the inhabitants of our Island possessions and the Canal Zone what they are too careless to do for their families and themselves. A late writer states that approximately 600,000 lives, worth when capitalized, to the country, more than a billion of dollars, are lost every year in the United States from preventable disease. With an organization such as is here outlined in every State, and with the Public Health Service, or better, a National Department of Health to co-ordinate and correlate the whole, and with a yearly expenditure of $25,000,-000, which is not a fourth of what we spend on either the Army or

Navy, we should save the billion of money, and better still we should save the lives.

The grave defects of the present organization of most health boards are, that they are unnecessarily cumbersome and that they tend to too much division of responsibility. Many of them are composed wholly or in part of laymen, who are totally unlearned in sanitary matters, and have neither the time nor opportunity to acquaint themselves with the subject. The services of the laymen who recognize their limitations, but give their time and efforts to the public health in default of more expert assistance, are not to be decried, and the public has had abundant reason to be grateful to them. Nevertheless, it is no more reasonable to expect a banker, a carpenter or a lawyer to understand sanitation than it is to expect a health officer to build a house, try a case in court or run a bank. When the city or the county desires to put up a public building, the plans are drawn by an architect; they are not prepared by the local jeweler or the superintendent of schools.

Then, too, lay health boards usually feel that health matters are best left in the hands of one more expert than themselves, and either by resolution or informally delegate their authority to the medical man on the board. If active, lay health boards are prone to interfere with energetic health campaigns, either on the score of expense or because it was not the way of the fathers. Neither way is desirable.

The single health officer, or health commissioner, as he is called in Indiana, has no board to hide behind. The responsibility is all his, and the credit or blame likewise. He may seek advice within or without the ranks of the profession, or of his State Board, but within his delegated powers he is supreme, and only liable for an unreasonable use of his office. Experience has shown that this system works well. Within his county he has co-ordinate authority with the State Board of Health, and an order from him is just as binding for the condemnation of an unsanitary schoolhouse or the settlement of a moot point in sanitation. This leads to celerity of action in handling health matters, but since the responsibility cannot be delegated nor shifted, makes also for judicial care in the execution of his duties.

CHAPTER XX.

LOCAL RECORDS, AND STATISTICAL METHODS.

Purposes.—A complete record of *Births, Deaths,* and *Infectious Diseases* should be kept in the office of every local health officer or Board of Health. These records are not primarily for their statistical value, since the central statistical authorities in all registration states compile the statistics from the originals filed with them. These are promptly published, are accurately collated by skilled statistical workers, and make any duplication unnecessary except perhaps in large cities. The real value of the local record is legal. The birth record is of value:

1. To prove citizenship, as for applicants for Government or State positions, or for passports, or for the exercise of the franchise.
2. To prove age, as for children desiring to enter or leave school, or exemption from child labor laws, or pension as soldiers' orphans, or admission to reform schools and orphanages.
3. To prove descent, as in inheritance and pension matters, and legitimacy.
4. From a genealogical standpoint.

The death record is important:

1. In probate affairs.
2. In pension matters.
3. To the genealogist.
4. To the family physician, and actuary.

The record of infectious diseases is also valuable:

1. To the sanitarian himself, as enabling him to see in black and white what portions of his territory are most defective and what progress he is making.
2. To the economist.
3. To the school authorities.
4. As modifying quarantine and allowing the release of immunes.

Records.—Records of *Marriage* and *Divorce* are sometimes kept and may become important either from the statistical or legal standpoint.

Birth and *Death* records should conform as nearly as possible to the standard forms. The only change should be in the heading, in which the name of the city or county may be printed in and the words "official copy" added.

If made up on the "loose-leaf" plan, these records are continuously self-indexing, and when a sufficient number have accumulated to make it worth while, say at the end of six months or one or two years, may be removed from the file, with the thumb indexes in place, and permanently bound. Records of this kind may be made on an ordinary typewriter, with a great gain in legibility. For this plan two things are requisite: a lock file or lock binder and printing on one side of certificate only, since only one face can be indexed.

This method may be modified by printing on both sides of the blank and using an ordinary index, either folio or card. This second plan admits of the use of a serial number, which is not allowed by the first, until just before binding, but makes necessary the use of the index.

Large folio records are also often used, but are less desirable as they require either the use of longhand or of an expensive book typewriter in copying.

Indexes.—Indexes are of two kinds, book and card. The book indexes are again divided into bound and loose-leaf. The bound indexes are of least value, since in small communities there will be an abnormal preponderance of one or more index letters which will fill up much more rapidly than others and either require transfers or put the book out of use when it is not half full. Under the loose-leaf system, additional pages may be added to take care of such a condition.

A properly cared for card system will index to any desired degree of refinement, and the typewriter can conveniently be used with consequent gain in convenience and legibility. One set of boxes is sufficient for a small series of records as differently colored cards may be used for births, deaths, marriages, divorces and contagious diseases, and when the index has accumulated to sufficient size these may be redistributed to new boxes.

No matter how the index is kept it must be absolutely complete

or it will lead to serious mistakes. If cards are used they must be properly alphabetted and never removed from the drawer. Cards which are locked into position by a rod passing through a hole or slot are more satisfactory for this reason.

Serial Numbers.—Serial numbers are necessary for easy reference to any set of records. They are of two kinds. One is used for originals sent to the central statistical office, and begins with the year at 1 and runs consecutively through the year. The second is a number which begins with the first record and runs consecutively until the number becomes unwieldy, beginning again at 1 with a check letter or number for a new series. The first form is obligatory. The second is optional, but of great convenience in connection with card or other general index systems.

Infectious Diseases.—The record of infectious diseases is most easily kept in a large folio with one line to an entry, extending across both pages. The headings for the perpendicular columns should be: Name of disease; Name; Address; Age; Sex; Social condition; Number in family; School attended; Schools attended by other children; By whom reported; Time reported (month, day, hour); Quarantine instituted (month, day, hour); Disinfected (month, day, hour); By whom disinfected.

These headings are also adaptable to the loose-leaf plan. Additional headings might be used for Remarks, under which details of vaccination, immunization, and antitoxin furnished, and Result, giving death or recovery.

A record kept on this plan would become increasingly more valuable, and could be depended on to show tuberculosis and typhoid infected foci beyond cavil.

Statistical Methods.—A short account of the principal rules which concern the health officer in his work of gathering the material for the statistician, follows. Those who are desirous of going into the subject more deeply for themselves will receive invaluable assistance from the publications of the Bureau of the Census.

Still-Births.—Certificates of death are usually required for still-births, and if the cause of pre-natal death is ascertainable it will be recorded in the same way as for deaths on the certificate. Still-births will not for statistical purposes be compiled as births or deaths, but separately. In case the registrar issues mortality reports from his office, he should bear this in mind, otherwise his

mortality rate will show unduly high. The fact that still-births are excluded should, however, be stated in the heading or in a foot-note.

Bulletins.—(*Rule No. 13, American Public Health Association.*)—Total deaths should include all the deaths that occurred in the given area during the period stated in the table, and no others:

(a) A weekly bulletin should include all deaths that occurred during the week ending at 12 midnight, Saturday, and no others: Provided that in order to secure earlier publication, a weekly bulletin may include *"deaths reported"* up to any time, but should definitely state that fact.

(b) A monthly bulletin should include all deaths that occurred during the month and no others.

(c) An annual report should include all deaths that occurred during the calendar year and no others.

Standard Tables.—(*Rule No. 44, A. P. H. A.*)—Every state or city registration office publishing an annual (or biennial) report should include therein a table showing the population (as estimated by the United States Census Bureau for intercensal years), total number of births exclusive of still-births, total number of deaths exclusive of still-births, total number of marriages, total number of divorces (providing this information can be obtained), for each year of registration.

Rule No. 45.—It is desirable that the corresponding rates be given, but the primary figures should be presented whether it is possible to present rates or not.

Rule No. 46.—Notes should be given in all instances where discrepant figures have been officially printed relative to returns for any year, and the correct figures be definitely stated.

Rule No. 47.—Notes should be given on changes in methods of compiling still-births, and a correct statement of still-births should be established for each year, on the basis of the methods approved. If necessary, re-examination of the original returns should be made for the purpose of obtaining comparable figures.

Population.—In order to calculate mortality rates, it is necessary to have an approximate idea of the population of the registration area. In the census years, this is not difficult, since the figures are furnished directly, but in the intercensal years it becomes a matter of calculation. In communities having a shifting population, it is easiest, and perhaps as accurate as any to assume

a population $2\frac{1}{2}$ times the number of children shown by the school enumeration.

The Census Bureau rule is much more complicated. The period from June 1, 1900, to April 15, 1910, is $118\frac{1}{2}$ months. A monthly increment is found by dividing the intercensal increment by 118.5. Two and one-half times this monthly increment are added to estimate the population on July 1, 1910. Then 12 times the monthly increase will be added to this estimated midyear population of 1910, to estimate for the midyear of 1911, and this same annual increment of 12 times the monthly increment will be added to the population for 1911 to find that for 1912, and so on to another census year.

Assuming that the census of 1920 is taken on April 15, as was the last, the problem will then be the very simple one of dividing the increase in any given area into 10 parts and adding one part for each succeeding year.

Both of these census methods are more accurate for large areas and populations than for small communities. Another factor to be taken into consideration with them is the considerable augmentations of area apt to take place in ten years in any growing city. Therefore, unless a state or police census is available, the sanitarian in a small place will do best to adopt the plan of multiplying the school census by $2\frac{1}{2}$ to estimate his population, particularly as these figures are usually available annually.

CHAPTER XXI.

THE BIRTH RECORD.

Importance.—Birth records are of prime importance in vital statistics, but so far not even a single State has succeeded in reaching a standard of report of 90 per cent of all births, which is necessary for acceptance in the registration area. Pennsylvania has a law based on the model framed by the Census Bureau, which was passed in 1910, and which if properly enforced will make her a registration state. Indiana has a rider to the Ophthalmia Neonatorum law, passed in 1911, requiring all births to be reported to the health authorities, who have charge of the registration, within 36 hours. The great difficulty with either one of these laws is that they must be enforced by the local authorities, who are busy men, full of the business of getting a living outside the meagerly paid health department. They do not feel like prosecuting a fellow physician for failing to report, and the law fails of its purpose. Both these laws are as yet too new to judge their efficiency, and it is to be hoped that they will succeed as well as similar laws do in European communities, where an unregistered birth is an unheard-of thing.

In Chapter XX., under the caption of *Local Records,* a number of reasons are given for the careful collection and recording of birth certificates, which for brevity's sake will not be repeated here. Suffice it to say, that experience in an office which has a well-indexed set of records extending over 29 years, and comprises some 13,000 names in a community having now about 23,500 souls, has shown that information asked for is not to be found in half the cases.

Checks.—This condition can be avoided in only one way, which is for the registrar to exercise continual vigilance. In well-to-do families, the birth, especially in small communities is reported in the papers. These must be scanned for notices of this kind. In poorer families, in both large and small communities, the infant mortality is high. Burials are fortunately under pretty good control. If deaths of children 1 year old or younger are investigated,

INDIANA STATE BOARD OF HEALTH

PHYSICIAN'S PERSONAL RECORD

REPORT OF BIRTH

Name of Mother

Name of Father

Date of Birth

Place of Birth

Sex Color

If out of wedlock and name not given write O. W.

Residence of Mother

Residence of Father

Nativity of Father

Nativity of Mother

Name of Child

Remarks

MARGIN RESERVED FOR BINDING.

WRITE PLAINLY, WITH UNFADING INK OR INDELIBLE PENCIL—THIS IS A PERMANENT RECORD.

N. B.—In case of more than one child at a birth, a SEPARATE RETURN must be made for each, and the number of each, in order of birth, stated. This certificate must be filled by the attending Physician or Midwife with the Local Health Officer within 20 days after birth.

PLACE OF BIRTH

County of

Township of

Village of
or
City of (No. St.; Ward)

INDIANA STATE BOARD OF HEALTH

DIVISION OF VITAL STATISTICS.

CERTIFICATE OF BIRTH.

Registered No.

FULL NAME OF CHILD { Born Alive? }

If child is not named, make supplemental report.

Sex of Child	Twin, Triplet, or Other	and { Number in order of birth	Legitimate?	Date of Birth 19 (Month) (Day) (Year)

FATHER		MOTHER	
Full Name		Full Maiden Name	
Residence		Residence	
Color or Race	Age at last Birthday (Years)	Color or Race	Age at last Birthday (Years)
Birthplace		Birthplace	
Occupation		Occupation	

Number of child of this mother	Number of children, of this mother, now living	Were precautions taken against Ophthalmia neonatorum?

CERTIFICATE OF ATTENDING PHYSICIAN OR MIDWIFE*

I hereby certify that I attended the birth of above child; and that it occurred on , 19 , at M.

{ * When there is no attending physician or midwife, then the householder should make this return. See Instructions on back. } (Signature)

(Attending physician, midwife, householder.*)

Given or christian name added from a supplemental report 19

HEALTH OFFICER.

Dated 19 Address

Filed 19

HEALTH OFFICER.

Form of Certificate of Birth used by Indiana State Board of Health. Size of original, eleven by six inches. The matter shown on opposite page is printed on rear of this blank.

THIS CERTIFICATE MAY BE NEEDED IN COURT SOME DAY TO PROVE LEGITIMACY OR PARENTAGE, TO SECURE INHERITANCE OF PROPERTY OR INSURANCE OR PENSION

REGISTRATION LAW

[APPROVED MARCH 9, 1907.]

SECTION 1. Be it enacted by the General Assembly of the State of Indiana, That it shall be the duty of all physicians and midwives in the state, to report upon blank forms supplied by the State Board of Health, all deaths and births that may occur under their supervision, and also all cases of contagious and infectious diseases which may occur under their supervision and which are listed as reportable in the rules of the State Board of Health.

The reports of deaths and cases of infectious diseases shall be made immediately and reports of births within twenty days after their occurrence. * * * * * * *

PENALTY.—"Any physician or midwife refusing or neglecting to make death, birth and infectious or contagious disease reports as herein provided, shall, upon conviction, be fined for the first offense in any sum not less than ten or more than fifty dollars, and any physician or midwife who is convicted the second time for the violation of any of the above provisious shall be fined not less than fifty or more than one hundred dollars, and any physiciau or midwife who is convicted the third time for the violatiou of any of the above provisions, shall be fined one hundred dollars. Householders and others made responsible in this act and failing to report as herein provided, shall, upou conviction, be fined not less than ten or more than fifty dollars for each offense."

RULE 5 OF THE STATE BOARD OF HEALTH.—Secretaries of all Boards of Health shall be diligent in performing all of their duties under the health statutes and the rules. They shall study and learn the said statutes and rules; they shall keep careful sanitary and hygienic supervision over their respective jurisdictions; they shall carefully collect and record certificates of deaths, certificates of births and reports of infectious diseases; they shall promptly file against and prosecute any physiciau, midwife or householder for failure to report deaths, births and infectious diseases, and they shall also file against and prosecute any person violating any health law within their respective jurisdiction. Any Secretary of any Board of Health who fails to fulfill and enforce this rule will be prosecuted by the State Board of Health, according to the statutes.

DUTY OF PHYSICIANS AND MIDWIVES ATTENDING BIRTHS.

The attending physician or midwife is required, under penalty provided in the law as quoted in the extract above, to file a properly made out certificate of birth with the health officer having jurisdiction within twenty days after birth. The local health officer is obliged, under penalty, to report violations of this requirement. No certificate made out in lead pencil will be accepted. PLEASE WRITE PLAINLY AND TAKE PAINS TO MAKE A CORRECT STATEMENT OF THE FACTS REQUIRED BY LAW, AS THE RECORD MAY BECOME OF GREAT LEGAL AND PERSONAL IMPORTANCE.

DUTY OF HEALTH OFFICERS AND DEPUTIES.

1. Appoint a deputy to act only in the illness, absence or other disqualification of the health officers and deputies.

2. Examine each Certificate of Birth when filed by the physician, midwife or other person and see that all of the items required by law are properly filled out. If absolutely impossible to ascertain any fact, the space should be filled by the word "Unknown." DO NOT ACCEPT A CERTIFICATE UNLESS MADE OUT IN INK OR INDELIBLE PENCIL, UNDER ANY CIRCUMSTANCES. A still-birth should be registered, both as a birth and as a death.

3. Immediately record the certificate in the local register, numbering it in order beginning with "No. 1" for the first birth that occurs in each year. ENTER THE SAME NUMBER ON THE CERTIFICATE, WITH DATE OF FILING IN YOUR OFFICE AND YOUR OFFICIAL SIGNATURE.

4. If christian name is not stated in original return, issue a "Supplemental Report" blank to the reporter, and record when returned.

5. Send in to State Board of Health, all Certificates of Birth in your possession, when making your report of deaths on the FOURTH (4th) day of the month, except only those belonging to the month just begun.

Copies of the law and blank certificates of birth will be supplied by local Health Officers or by the State Board of Health.

it will often be found that the birth has never been reported. Of course both checks apply more or less to all classes of society, but have more weight in the divisions above cited. When such derelictions are found, it becomes the duty of the registrar to file information and prosecute the offender. Such duties are unpleasant, but if done without fear or favor, after having plainly brought the law to the attention of all who may be affected by it, one or two examples are sufficient to convert the most recalcitrant, and the further enforcement of the law gives little trouble.

Certificates.—There is no general standard birth certificate as yet adopted, and the very complete and practical certificate of the Indiana State Board of Health is here presented as one covering all the necessary points both from a statistical and a legal point of view.

The certificates are issued on requisition to all health officers, who in turn put them into the hands of physicians and midwives. They are conveniently bound in blocks of 10, and are composed of the certificate proper and a stub, a line of perforations affording easy separation. The certificate is 6 inches high by 8 inches wide, and the stub 6x4. The stub contains in abbreviated form the data on the certificate, and is for the personal record of the physician. If he utilizes the back of the stub, he has sufficient room for a very good clinical record.

HEADINGS.—The headings of this birth certificate conform to those of the standard death certificate with the exceptions to be noted.

NAME OF CHILD.—The name of the child is frequently not to be had at the time of making the return, and provision is made for a supplementary return which follows the original through the local health office, where the name is added to the record, to the Division of Vital Statistics of the State Board of Health, where it is bound up with the original. As the check number is the same on both original and supplement, the identification is easy.

BORN ALIVE?—This query answers definitely whether or not the child was still-born. The registrar must see that it is answered.

SEX.—This is occasionally omitted carelessly by the physician, and must be definitely answered as it is never safe to infer it from the name.

PLURAL BIRTHS.—Two headings, "Twin, Triplet or Other" and "Number in order of birth," give more trouble than any others.

They relate exclusively to plural births, but are often filled in for single births. Fortunately this gives rise to no confusion.

LEGITIMATE?—This must be answered by yes or no.

DATE OF BIRTH.—This point is covered by two different headings which must agree, one in the body of the certificate and the other in the certificate of the attending physician or midwife.

OCCUPATION OF PARENTS.—Space is given for the occupation of both parents. In time this will show the effect of various occupations of the parents on the birth rate, and when collated with the mortality statistics, on the infantile death-rate.

NUMBER OF CHILD OF THIS MOTHER.—And "Number now living." The questions noted in the last paragraph are partly answerable from the certificate itself, by checking the answers to these two questions.

OPHTHALMIA NEONATORUM.—The attendant must answer on the certificate itself whether or not precautions were taken against ophthalmia neonatorum. The fact that it must be answered yes or no, and that failure to take such precautions would be most damaging in case of infection, has a great tendency to prevent neglect.

FILE MARKS.—The filing and recording of the paper must be authenticated by the signature of the Health Officer. In case he adds the name from a supplementary report which reaches him before the fourth of the following month, he also certifies to that fact, and does not cumber the files by sending in the supplement.

RESPONSIBILITY.—To recapitulate: The essentials of a successful law for recording births are: responsibility on physician or midwife if present or parents if birth is unattended; efficient local registrars; a central authority to which all certificates are sent after record, which central office must provide for filing and preservation; control of all local authorities by the central agency; penalties provided and enforced for all infractions of the law.

PLACE OF BIRTH

County of ....

Township of ....

Town or
City of ....

INDIANA STATE BOARD OF HEALTH

DIVISION OF VITAL STATISTICS.

SUPPLEMENTAL REPORT OF BIRTH.

(This return should preferably be made by the person who made the original.)

Registered Number* ....

P. O. Address of Mother .... **Street and No.** ....

SEX OF CHILD*	Twin, triplet, or other?	Number and in order of birth*
Date of Birth* .... (Month) .... (Day) ....1910 (Year)		
FATHER Full Name*		
MOTHER Full Maiden Name*		

***I Hereby Certify,* That the child described herein has been named:**

.... (Given name, in full) (Surname)

....
Signature of Physician, Midwife or Householder.

....
P. O. Address of Physician, Midwife or Householder.

* These items to be entered by the Health Officer before giving out this form.

Exact size of Supplemental Report of Birth used by the Indiana State Board of Health. See opposite page for matter printed on reverse side of this form.

SUPPLEMENTAL REPORT OF GIVEN OR CHRISTIAN NAME OF CHILD.

RULE: "When any certificate of birth of a living child is presented without statement of the given or christian name, then the local Health Officer shall deliver to the informant a special blank for the report of the given or christian name of the child, which shall be filled out with the full name of the child, including given or christian name and surname, as soon as said child shall be named, which said informant shall forthwith deliver the properly filled out blank to the local Health Officer. THE ORIGINAL CERTIFICATE OF BIRTH SHALL NOT BE CONSIDERED TO BE COMPLETE UNTIL SUCH STATEMENT OF GIVEN OR CHRISTIAN NAME SHALL BE FILED OR THE BLANK RETURNED WITH THE STATEMENT 'DIED UNNAMED.'"

☞ Health Officers should enter the given or christian names upon the local Records and return the slip to the State Board of Health when making the returns of deaths on the fourth day of the following month.

(Reverse view of form shown on opposite page.)

CHAPTER XXII.

REPORTS OF COMMUNICABLE DISEASES.

It is self-evident that the health officer cannot take action upon any case of infectious or communicable disease until he has knowledge of it. The law therefore provides that anyone, and more particularly any physician, having knowledge of a notifiable disease must report it to the health authorities, when the responsibility of the health officer for quarantine and related matters at once begins. Failure to receive a formal notification does not, however, relieve him from responsibility, for in case he hears of it in any other way, he must at once investigate and take appropriate action, which under such circumstances would probably not only include quarantine, but prosecution of the offenders.

Blanks.—The blanks used for the notification of the health officer are usually rather small, since they are supposed to be carried in the pocket or handbag of the physician, at least in times of epidemics. For the convenience of the health officer, a larger blank carrying the necessary data and with a sufficiently large margin to allow filing on an arch file or loose-leaf system would be preferable. It would allow subsequent separation by diseases and a secondary separation alphabetically, so that both copying and indexing might be obviated.

A blank 4x8 inches, of which 1 inch would be utilized for binding, bound in pads of 25, with a Manila back, would, if doubled, take up not quite so much room as the present customary 3½x6 inch size, and would give room for much important information not usually put down on the reports.

Physicians should be required to use ink or indelible pencil in making out these reports, as well as for those of a more permanent nature.

The headings should be as follows:

Name of disease; Name of patient; Address; Age; Sex; Social condition; Number in family; School attended; Schools attended by other members of family; By whom reported; Time reported

(month, day, hour); Quarantine instituted (month, day, hour); Disinfected (month, day, hour); By whom disinfected.

For his own protection the health officer should keep this record in perfect condition all the time, and should keep the originals, if authorized to do so, or transmit them promptly to the proper office as the law may require. Then he will be in position to show exactly what has or has not been done in case any question arises.

CHAPTER XXIII.

REGISTRATION OF DEATHS.

Importance.—The importance of a complete and proper registration of deaths is not to be over-estimated from a sanitary standpoint. Without it all statistics are worthless, yet the registration area of the United States only covers some 60 per cent of the population, comprising the states (in the order of their admission to the registration area) of Massachusetts, New Jersey, the District of Columbia, Connecticut, New Hampshire, Rhode Island, Vermont, Maine, Michigan, Indiana, California, Colorado, Maryland, Pennsylvania, South Dakota, Washington, Wisconsin, Ohio, Kentucky, and Missouri, with isolated cities in other states. It is hoped, however, on the basis of 1910 reports to add Delaware, Minnesota, Montana, Nebraska, North Dakota, Oregon, and Utah, with municipalities in North Carolina. This will greatly extend the value of the mortality statistics, but still leaves a notable deficiency, particularly in the South.

Essentials.—1. Immediate registration of deaths, with issuance of a permit, before burial. This rule must be absolute, with no exception permissible. In coroner's cases, where the cause of death is still in doubt, the permit may be granted on the coroner's certificate "pending investigation."

2. A standard certificate, of the form shown on page 216. Since this form is adopted by most of the registration states, and since only comparable statistics are of value, it is best to adopt it in order that reports may be uniform.

3. Efficient local registrars, who are preferably either health officers or someone under their supervision. No one else can have so keen an appreciation of the value of vital statistics as the sanitarian, and no one else is so apt to take interest and pride in their collection. He should report directly to the state authorities, without any local officer intervening. This report should consist of the original death certificates, with a simple card of transmittal, giving the first and last numbers of certificates enclosed, with the

official signature of the registrar, the date and the official name of his district. If no deaths occur in his territory, a "No Death" card replaces the report.

4. A state registrar, who has full supervision, authority and responsibility for the collection of the vital statistics of the state, and who is not afraid to enforce the penalties of the law for neglect of duty.

5. Responsibility for securing death certificate and burial permit completely placed on the undertaker or other person disposing of the body.

6. For legal purposes, a local record which is an exact official copy of the original certificate. This is more fully discussed under the head of *Local Records*.

7. Eternal vigilance on the part of the registrar to see that no bodies are buried without permits, and prompt prosecution for neglect or wilful violation of the law. The penalties for interment without permits vary from state to state. One of the most useful methods of enforcing the law is to place the expenses of the Coroner's inquest, including autopsy, upon the person responsible for the burial, in addition to the fine.

The Standard Certificate.—The American Public Health Association has adopted a standard form of death certificate, which as already stated is in use in most of the registration states. This form was revised to be in use from January 1, 1910. The various points in its composition will be taken up in detail. The numbers refer to identical numbers on the certificate.

(1) Place of Death.—The place of death should be given with particularity, giving county and city; or in the country, giving township and county. If the death is in a neighborhood in the country known by a well identified name, the neighborhood name may be placed in the space reserved for street and number in cities. Similarly, if death occurs in an institution, the name of the institution, as "County Poor Asylum" or "Home for the Aged" should be written in that space, the supplementary information being placed in space 18.

(2) Full Name.—As all experienced registrars know, the name is occasionally a source of difficulty. If a body is unidentifiable, "Unknown" should be written in. If an unnamed infant, the name should be given as "Unnamed Infant ——." Where death certificates are required for still-born children, the same rule applies.

Standard Certificate of Death.

MARGIN RESERVED FOR BINDING

WRITE PLAINLY, WITH UNFADING INK—THIS IS A PERMANENT RECORD

N. B.—Every item of information should be carefully supplied. AGE should be stated EXACTLY. PHYSICIANS should state CAUSE OF DEATH in plain terms, so that it may be properly classified. Exact statement of OCCUPATION is very important. See instructions on back of certificate.

V. S. No. 2

1 PLACE OF DEATH

County ....

Township .... or

Village .... or

City .... (No. ...., ... St., ... Ward) (If death occurred in a hospital or institution, give its NAME instead of street and number.)

Department of Commerce and Labor
BUREAU OF THE CENSUS

STANDARD CERTIFICATE OF DEATH

State of ....

Registered No. ....

2 FULL NAME ....

PERSONAL AND STATISTICAL PARTICULARS		
3 SEX	4 COLOR OR RACE	5 SINGLE, MARRIED, WIDOWED, OR DIVORCED (Write the word)
6 DATE OF BIRTH .... (Month) (Day), 1.......... (Year)		
7 AGE .... yrs. .... mos. .... ds.	If LESS than 1 day, ... hrs. or .... min.?	
8 OCCUPATION (a) Trade, profession, or particular kind of work .... (b) General nature of Industry, business, or establishment in which employed (or employer)		
9 BIRTHPLACE (State or country)		
PARENTS	10 NAME OF FATHER	
	11 BIRTHPLACE OF FATHER (State or country)	
	12 MAIDEN NAME OF MOTHER	
	13 BIRTHPLACE OF MOTHER (State or country)	
14 THE ABOVE IS TRUE TO THE BEST OF MY KNOWLEDGE (Informant) .... (Address)		
15 Filed ...., 191.... .... REGISTRAR		

MEDICAL CERTIFICATE OF DEATH	
16 DATE OF DEATH .... (Month) (Day), 191.... (Year)	
17 I HEREBY CERTIFY, That I attended deceased from ...., 191...., to ...., 191...., that I last saw h.... alive on ...., 191...., and that death occurred, on the date stated above, at .... m. The CAUSE OF DEATH* was as follows: .... (Duration) .... yrs. .... mos. .... ds. Contributory (SECONDARY) .... (Duration) .... yrs. .... mos. .... ds. (Signed) ...., M. D. ...., 191.... (Address)	
* State the DISEASE CAUSING DEATH, or, in deaths from VIOLENT CAUSES, state (1) MEANS OF INJURY; and (2) whether ACCIDENTAL, SUICIDAL, or HOMICIDAL.	
18 LENGTH OF RESIDENCE (FOR HOSPITALS, INSTITUTIONS, TRANSIENTS, OR RECENT RESIDENTS) At place of death .... yrs. .... mos. .... ds. In the State .... yrs. .... mos. .... ds. Where was disease contracted, if not at place of death? .... Former or usual residence	
19 PLACE OF BURIAL OR REMOVAL	DATE OF BURIAL ...., 191....
20 UNDERTAKER	ADDRESS

11—3184

Standard Certificate of Death approved by United States Census and American Public Health Association. Size of original form, 8½ inches long by 7¼ inches wide. See opposite page for matter printed on reverse side of this certificate.

The Following Matter is Printed on Reverse Side of "Standard Certificate of Death" Shown on Opposite Page.

Revised United States Standard Certificate of Death

[Approved by U. S. Census and American Public Health Association]

Statement of occupation.—Precise statement of occupation is very important, so that the relative healthfulness of various pursuits can be known. The question applies to each and every person, irrespective of age. For many occupations a single word or term on the first line will be sufficient, e. g., *Farmer* or *Planter*, *Physician*, *Compositor*, *Architect*, *Locomotive engineer*, *Civil engineer*, *Stationary fireman*, etc. But in many cases, especially in industrial employments, it is necessary to know (*a*) the kind of work and also (*b*) the nature of the business or industry, and therefore an additional line is provided for the latter statement; it should be used only when needed. As examples: (*a*) *Spinner*, (*b*) *Cotton mill*; (*a*) *Salesman*, (*b*) *Grocery*; (*a*) *Foreman*, (*b*) *Automobile factory*. The material worked on may form part of the second statement. Never return "Laborer," "Foreman," "Manager," "Dealer," etc., without more precise specification, as *Day laborer*, *Farm laborer*, *Laborer—Coal mine*, etc. Women at home, who are engaged in the duties of the household only (not paid *Housekeepers* who receive a definite salary), may be entered as *Housewife*, *Housework*, or *At home*, and children, not gainfully employed, as *At school* or *At home*. Care should be taken to report specifically the occupations of persons engaged in domestic service for wages, as *Servant*, *Cook*, *Housemaid*, etc. If the occupation has been changed or given up on account of the DISEASE CAUSING DEATH, state occupation at beginning of illness. If retired from business, that fact may be indicated thus: *Farmer* (*retired, 6 yrs.*). For persons who have no occupation whatever, write *None*.

Statement of cause of death.—Name, first, the DISEASE CAUSING DEATH (the primary affection with respect to time and causation), using always the same accepted term for the same disease. Examples: *Cerebrospinal fever* (the only definite synonym is "Epidemic cerebrospinal meningitis"); *Diphtheria* (avoid use of "Croup"); *Typhoid fever* (never report "Typhoid pneumonia") *Lobar pneumonia*; *Bronchopneumonia* ("Pneumonia," unqualified, is indefinite); *Tuberculosis of lungs, meninges, peritoneum*, etc., *Carcinoma*, *Sarcoma*, etc., of............(name origin; "Cancer" is less definite; avoid use of "Tumor" for malignant neoplasms); *Measles*; *Whooping cough*; *Chronic valvular heart disease*; *Chronic interstitial nephritis*, etc. The contributory (secondary or intercurrent) affection need not be stated unless important. Example: *Measles* (disease causing death), *29 ds*; *Bronchopneumonia* (secondary), *10 ds*. Never report mere symptoms or terminal conditions, such as "Asthenia," "Anæmia" (merely symptomatic), "Atrophy," "Collapse," "Coma," "Convulsions," "Debility" ("Congenital," "Senile," etc.), "Dropsy," "Exhaustion," "Heart failure," "Hæmorrhage," "Inanition," "Marasmus," "Old age," "Shock," "Uræmia," "Weakness," etc., when a definite disease can be ascertained as the cause. Always qualify all diseases resulting from childbirth or miscarriage, as "PUERPERAL *septichæmia*," "PUERPERAL *peritonitis*," etc. State cause for which surgical operation was undertaken. For VIOLENT DEATHS state MEANS OF INJURY and qualify as ACCIDENTAL, SUICIDAL, or HOMICIDAL, or as *probably* such, if impossible to determine definitely. Examples: *Accidental drowning*; *Struck by railway train—accident*; *Revolver wound of head—homicide*; *Poisoned by carbolic acid—probably suicide*. The nature of the injury, as fracture of skull, and consequences (e. g., *sepsis*, *tetanus*) may be stated under the head of "Contributory." (Recommendations on statement of cause of death approved by Committee on Nomenclature of the American Medical Association.)

NOTE.—Individual offices may add to above list of undesirable terms and refuse to accept certificates containing them. Thus the form in use in New York City states: "Certificates will be returned for additional information which give any of the following diseases, without explanation, as the sole cause of death: Abortion, cellulitis, childbirth, convulsions, hæmorrhage, gangrene, gastritis, erysipelas, meningitis, miscarriage, necrosis, peritonitis, phlebitis, pyæmia, septichæmia, tetanus." But general adoption of the minimum list suggested will work vast improvement, and its scope can be extended at a later date.

sirable names has been appended to this chapter. It has the sanction of the American Public Health Association, as well as of the Census Bureau, and should be closely followed.

Particular care should be taken that the real cause of death and not a symptom, as shock, hemorrhage or uremia is stated. This seems to be a hard thing for physicians in general to understand, and the only remedy is to insist on a better classification by sending the report back for correction, or in aggravated cases, calling for an inquest.

(18) Residence in Hospitals, Etc.—This information is important to supplement the information contained in (1), and should always be insisted on, in the cases where applicable.

The remaining heads are self-explanatory.

Reverse Side.—The reverse side contains a large amount of explanatory matter, concerning causes of death, etc.

INTERNATIONAL LIST OF CAUSES OF DEATH.

[Second Decennial Revision, in effect January 1, 1910.]

Note.—There is also a List of Causes of Sickness, of precisely identical general form but containing some additional titles, which should be used for hospital and general morbidity statistics. In reporting causes of death upon certificates of death the physician is requested to read carefully the instructions upon the back of the certificate (see Standard Certificate of Death) and enter, *first* **THE NAME OF THE DISEASE CAUSING DEATH**; second, the name of the contributory (secondary) cause, if any; and, third, the **duration** of each cause. (If death was influenced by occupation, please see that kind of work and industry are correctly stated.) **In naming the disease causing death it is urgently recommended that the exact names printed in bold-faced type in the List below be employed, whenever they are applicable, and that no other terms be used instead.** Thus, *always* write **Typhoid fever**; not sometimes *Typhoid fever*, sometimes *Enteric fever*, or "*Continued fever*," "*Typho-malarial fever*," etc. Of course many diseases are not given in the terms in bold-faced type below, but only the most important ones. For others, any terms recommended by the Nomenclature of Diseases of the Royal College of Physicians, London (fourth edition, 1906), or the Nomenclature of Diseases and Conditions of Bellevue and Allied Hospitals, New York (last edition, 1910), may be used pending the publication of an American Nomenclature of Diseases now in hand by the committee of the American Medical Association. *Terms printed in italics are indefinite or otherwise undesirable, and should never be used when a more definite statement can be given.* "*Heart failure*," for example, is simply equivalent to cause of death unknown. "*Convulsions*," "*Marasmus*," "*Debility*," "*Old age*," are terms of this character. **Please aid in the improvement of our vital statistics by using only precise and definite terms.**

(I.—GENERAL DISEASES.)

1. Typhoid fever.
2. Typhus fever.
3. Relapsing fever. [Insert "(spirillum)."]
4. Malaria.
5. Smallpox.
6. Measles.
7. Scarlet fever.
8. Whooping cough.
9. Diphtheria and *croup*.
10. Influenza.
11. Miliary fever. [True Febris miliaris only.]
12. Asiatic cholera.
13. *Cholera nostras*.
14. Dysentery.
15. Plague.
16. Yellow fever.
17. Leprosy.
18. Erysipelas. [State also cause; see Class XIII.]
19. Other epidemic diseases:

    Mumps,
    German measles,
    Chickenpox.
    Rocky Mountain spotted (tick) fever,
    Glandular fever, etc.

20. Purulent infection and septichæmia. [State also cause; see Classes VII and XIII especially.]
21. Glanders.
22. Anthrax.
23. Rabies.
24. Tetanus. [State also cause; see Class XIII.]
25. Mycoses. [Specify, as Actinomycosis of lung, etc.]
26. Pellagra.
27. Beriberi.
28. Tuberculosis of the lungs.
29. Acute miliary tuberculosis.
30. Tuberculous meningitis.
31. Abdominal tuberculosis.
32. Pott's disease. [Preferably Tuberculosis of spine.]
33. *White swellings*. [Preferably Tuberculosis of —— joint.]
34. Tuberculosis of other organs. [Specify organ.]
35. Disseminated tuberculosis. [Specify organs affected.]
36. Rickets.
37. Syphilis.
38. Gonococcus infection.

39. Cancer [1] of *the buccal cavity.* [State part.]
40. Cancer [1] of the stomach, liver.
41. Cancer [1] of the peritonæum, intestines, rectum.
42. Cancer [1] of *the female genital organs.* [State organ.]
43. Cancer [1] of the breast.
44. Cancer [1] of *the skin.* [State part.]
45. Cancer [1] of *other or unspecified organs.* [State organ.]
46. Other *tumors* (tumors of the female genital organs excepted.) [Name kind of *tumor* and organ affected. Malignant?]
47. Acute articular rheumatism.
48. Chronic rheumatism and gout. [Preferably Arthritis deformans.]
49. Scurvy.
50. Diabetes. [Diabetes mellitus.]
51. Exophthalmic goitre.
52. Addison's disease.
53. Leuchæmia.
54. Anæmia, chlorosis. [State form or cause.]
55. Other general diseases:

    Diabetes insipidus,
    Purpura hæmorrhagica, etc.

56. Alcoholism (acute or chronic).
57. Chronic lead poisoning. [State cause. Occupational?]
58. Other chronic occupation poisonings:

    Phosphorus poisoning (match factory),
    Mercury poisoning (mirror factory), etc.

59. Other chronic poisonings:

    Chronic morphinism,
    Chronic cocainism, etc.

(II.—Diseases of the Nervous System and of the Organs of Special Sense.)

60. *Encephalitis.*
61. *Meningitis:*

    Cerebrospinal fever or Epidemic cerebrospinal meningitis,
    Simple meningitis. [State cause.]

62. Locomotor ataxia.
63. Other diseases of the spinal cord:

    Acute anterior poliomyelitis,
    Paralysis agitans,

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[1] "Cancer and other malignant tumors." Preferably reported as Carcinoma of——, Sarcoma of——, Epithelioma of——, etc., stating the exact nature of the neoplasm and the organ or part of the body first affected.

63. Other diseases of the spinal cord — *Cont.:*
Chronic spinal muscular atrophy,
Primary lateral sclerosis of spinal cord,
Syringomyelia, etc.

64. Cerebral hæmorrhage, apoplexy.
65. *Softening of the brain.* [State cause.]
66. *Paralysis without specified cause.* [State form or cause.]
67. General paralysis of the insane.
68. Other forms of mental alienation. [Name disease causing death. Form of insanity should be named as CONTRIBUTORY CAUSE only *unless* it is actually the disease causing death.]
69. Epilepsy.
70. *Convulsions* (*nonpuerperal*). [State cause.]
71. *Convulsions of infants.* [State cause.]
72. Chorea.
73. Neuralgia and neuritis. [State cause.]
74. Other diseases of the nervous system. [Name the disease.]
75. Diseases of the eyes and their annexa. [Name the disease.]
76. Diseases of the ears. [Name the disease.]

(III.—DISEASES OF THE CIRCULATORY SYSTEM.)

77. Pericarditis. [Acute or chronic; rheumatic (47), etc.]
78. Acute endocarditis. [Cause?]
79. Organic diseases of the heart: [Name the disease.]

Chronic valvular disease, [Name the disease.]
Aortic insufficiency,
Chronic endocarditis,
Fatty degeneration of heart, etc.

80. Angina pectoris.
81. Diseases of the arteries, atheroma, aneurysm, etc.
82. Embolism and thrombosis. [State organ. Puerperal (139)?]
83. Diseases of the veins (varices, hæmorrhoids, phlebitis, etc.).
84. Diseases of the lymphatic system (lymphangitis, etc.) Cause? Puerperal?]
85. Hæmorrhage; other diseases of the circulatory system. [Cause? *Pulmonary hæmorrhage* from Tuberculosis of lungs (28)? Puerperal?]

(IV.—DISEASES OF THE RESPIRATORY SYSTEM.)

86. Diseases of the nasal fossæ. [Name disease.]
87. Diseases of the larynx. [Name disease. Diphtheritic?]

88. Diseases of the thyroid body. [Name disease.]
89. **Acute bronchitis.**
    [Always state as **acute** or **chronic.**]
90. **Chronic bronchitis.**
91. **Bronchopneumonia.** [If secondary, give *primary* cause.]
92. *Pneumonia.* [If lobar, report as **Lobar pneumonia.**]
93. **Pleurisy.** [If tuberculous, so report (28).]
94. *Pulmonary congestion, pulmonary apoplexy.* [Cause?]
95. **Gangrene of the lung.**
96. **Asthma.** [Tuberculosis?]
97. **Pulmonary emphysema.**
98. Other diseases of the respiratory system (tuberculosis excepted). [Such indefinite returns as "*Lung trouble,*" "*Pulmonary hæmorrhage,*" etc., compiled here, vitiate statistics. **Tuberculosis of the lungs** (28)? Name the disease.]

(V.—Diseases of the Digestive System.)

99. Diseases of the mouth and annexa. [Name disease.]
100. Diseases of the pharynx. [Name disease. Diphtheritic?]
101. Diseases of the œsophagus. [Name disease.]
102. **Ulcer of the stomach.**
103. Other diseases of the stomach (cancer excepted). [Name disease. Avoid such indefinite terms as "*Stomach trouble,*" "*Dyspepsia,*" "*Indigestion,*" "*Gastritis,*" etc., when used vaguely.]
104. **Diarrhœa and enteritis** (under 2 years).
105. **Diarrhœa and enteritis** (2 years and over).
106. **Ankylostomiasis.** [Better, for the United States, **Hookworm disease** or **Uncinariasis.**]
107. Intestinal parasites. [Name species.]
108. **Appendicitis and typhlitis.**
109. **Hernia, intestinal obstruction.** [State form and whether **strangulated.** Include only **organic intestinal obstruction.**]
110. Other diseases of the intestines. [Name disease.]
111. **Acute yellow atrophy of the liver.**
112. **Hydatid tumor of the liver.**
113. **Cirrhosis of the liver.**
114. **Biliary calculi.**
115. Other diseases of the liver. ["*Liver complaint*" is not a satisfactory return.]
116. Diseases of the spleen. [Name disease.]
117. *Simple* **peritonitis (nonpuerperal).** [Give cause.]
118. Other diseases of the digestive system (cancer and tuberculosis excepted). [Name disease.]

(VI.—NONVENEREAL DISEASES OF THE GENITOURINARY SYSTEM AND ANNEXA.)

119. Acute nephritis. [State cause, especially if due to Scarlet fever, etc.]
120. Bright's disease. [Better, Chronic Bright's disease, Chronic interstitial nephritis, Chronic parenchymatous nephritis, etc. Never report mere names of symptoms, as "*Uræmia*," "*Uræmic coma*," etc.]
121. Chyluria.
122. Other diseases of the kidneys and annexa. [Name disease.]
123. Calculi of the urinary passages. [Name bladder, kidney.]
124. Diseases of the bladder. [Name disease.]
125. Diseases of the urethra, urinary abscess, etc. [Name disease. Gonorrhœal (38)?]
126. Diseases of the prostate. [Name disease.]
127. Nonvenereal diseases of the male genital organs. [Name disease.]
128. Uterine hæmorrhage (nonpuerperal).
129. Uterine tumor (noncancerous). [State kind.]
130. Other diseases of the uterus. [Name disease.]
131. Cysts and other tumors of the ovary. [State kind.]
132. Salpingitis and other diseases of the female genital organs. [Name disease. Gonorrhœal (38)?]
133. Nonpuerperal diseases of the breast (cancer excepted). [Name disease.]

(VII.—THE PUERPERAL STATE.)

NOTE.—The term puerperal is intended to include pregnancy, parturition, and lactation. Whenever parturition or miscarriage has occurred within one month before the death of the patient, the fact should be certified, even though childbirth may not have contributed to the fatal issue. Whenever a woman of childbearing age, especially if married, is reported to have died from a disease which might have been puerperal, the local registrar should require an explicit statement from the reporting physician as to whether the disease was or was not puerperal in character. The following diseases and symptoms are of this class:

Abscess of the breast,
Albuminuria,
Cellulitis,
Coma,
Convulsions,
Eclampsia,
Embolism,
Gastritis,
Hæmorrhage (uterine or *unqualified),*
Lymphangitis,
Metritis,
Metroperitonitis,
Metrorrhagia,
Pelviperitonitis,
Peritonitis,
Phlegmasia alba dolens,
Phlebitis,
Pyæmia,
Septichæmia,
Sudden death,
Tetanus,
Thrombosis.

Physicians are requested always to write **Puerperal** before the above terms and others that might be puerperal in character, or to add in parentheses (**Not puerperal**), so that there may be no possibility of error in the compilation of the mortality statistics; also to respond courteously to the requests of the local registrars for additional information when, inadvertently, the desired data are omitted. The value of such statistics can be greatly improved by cordial coöperation between the medical profession and the registration officials. If a physician will not write the true statement of puerperal character on the certificate, he may privately communicate that fact to the local or state registrar, or write the number of the International List under which the death should be compiled, e.g., "Peritonitis (137)."

134. Accidents[1] of pregnancy: [Name the condition.]

Abortion, [Term not used in invidious sense; **Criminal abortion** should be so specified (184).]
Miscarriage,
Ectopic gestation,
Tubal pregnancy, etc.

135. **Puerperal hæmorrhage.**
136. Other accidents[1] of labor: [Name the condition.]

Cæsarean section,
Forceps application,
Breech presentation,
Symphyseotomy,
Difficult labor,
Rupture of uterus in labor, etc.

137. **Puerperal septichæmia.**
138. **Puerperal albuminuria** and **convulsions.**
139. **Puerperal phlegmasia alba dolens, embolus, sudden death.**
140. **Following childbirth** (*not otherwise defined*). [Define.]
141. **Puerperal diseases of the breast.**

(VIII.—Diseases of the Skin and Cellular Tissue.)

142. **Gangrene.** [State part affected, **Diabetic** (50), etc.]
143. **Furuncle.**
144. *Acute abscess.* [Name part affected, nature, or cause.]
145. Other diseases of the skin and annexa. [Name disease.]

(IX.—Diseases of the Bones and of the Organs of Locomotion.)

146. Diseases of the bones (tuberculosis excepted): [Name disease.]

[1] In the sense of *conditions or operations dependent upon* pregnancy or labor, not "accidents" from external causes.

Osteoperiostitis, [Give cause.]
Osteomyelitis,
Necrosis, [Give cause.]
Mastoiditis, etc. [Following **Otitis media** (76) ?]

147. Diseases of the joints (tuberculosis and rheumatism excepted). [Name disease; always specify **Acute articular rheumatism** (47), **Arthritis deformans** (48), **Tuberculosis of —— joint** (33), etc., when cause is known.]

148. *Amputations.* [Name disease or injury requiring amputation, thus permitting proper assignment elsewhere.]

149. Other diseases of the organs of locomotion. [Name disease.]

(X.—Malformations.)

150. **Congenital malformations** (stillbirths not included): [Do not include **Acquired hydrocephalus** (74) or **Tuberculous hydrocephalus** (**Tuberculous meningitis**) (30) under this head.]
Congenital hydrocephalus,
Congenital malformation of heart,
Spina bifida, etc.

(XI.—Diseases of Early Infancy.)

151. *Congenital debility,* **icterus,** and **sclerema:** [Give cause of *debility*.]
Premature birth,
Atrophy, [Give cause.]
Marasmus, [Give cause.]
Inanition, etc. [Give cause.]

152. Other diseases peculiar to early infancy:
Umbilical hæmorrhage,
Atelectasis,
Injury by forceps at birth, etc.

153. **Lack of care.**

(XII.—Old Age.)

154. *Senility.* [Name the disease causing the death of the old person.]

(XIII.—Affections Produced by External Causes.)

Note.—Coroners, medical examiners, and physicians who certify to deaths from violent causes, should always clearly indicate the fundamental distinction of whether the death was due to **Accident, Suicide,** or **Homicide;** and then state the **Means or instrument of death.** The qualification "*probably*" may be added when necessary.

155. Suicide by poison. [Name poison.]
156. Suicide by asphyxia. [Name means of death.]
157. Suicide by hanging or strangulation. [Name means of strangulation.]
158. Suicide by drowning.
159. Suicide by firearms.
160. Suicide by cutting or piercing instruments. [Name instrument.]
161. Suicide by jumping from high places. [Name place.]
162. Suicide by crushing. [Name means.]
163. Other suicides. [Name means.]
164. Poisoning by food. [Name kind of food.]
165. Other acute poisonings. [Name poison; specify Accidental.]
166. Conflagration. [State fully, as Jumped from window of burning dwelling, Smothered — burning of theater, Forest fire, etc.]
167. Burns (conflagration excepted). [Includes Scalding.]
168. Absorption of deleterious gases (conflagration excepted):

    Asphyxia by illuminating gas (accidental),
    Inhalation of —— (accidental), [Name gas.]
    Asphyxia (accidental), etc. [Name gas.]
    Suffocation (accidental), etc. [Name gas.]

169. Accidental drowning.
170. Traumatism by firearms. [Specify Accidental.]
171. Traumatism by cutting or piercing instruments. [Name instrument. Specify Accidental.]
172. Traumatism by fall. [For example, Accidental fall from window.]
173. Traumatism in mines and quarries:

    Fall of rock in coal mine,
    Injury by blasting, slate quarry, etc.

174. Traumatism by machines. [Specify kind of machine, and if the Occupation is not fully given under that head, add sufficient to show the exact industrial character of the fatal injury. Thus, Crushed by passenger elevator; Struck by piece of emery wheel (knife grinder); Elevator accident, (pile driver), etc.]
175. Traumatism by other crushing:

    Railway collision,
    Struck by street car,
    Automobile accident,
    Run over by dray,
    Crushed by earth in sewer excavation, etc.

176. Injuries by animals. [Name animal.]
177. **Starvation.** [Not "inanition" from disease.]
178. Excessive cold. **[Freezing.]**
179. Excessive heat. **[Sunstroke.]**
180. **Lightning.**
181. **Electricity** (lightning excepted). [How? Occupational?]
182. **Homicide by firearms.**
183. **Homicide by cutting or piercing instruments.** [Name instrument.]
184. **Homicide** by other means. [Name means.]
185. *Fractures (cause not specified).* [State means of injury. The nature of the lesion is necessary for hospital statistics but not for general mortality statistics.]
186. Other external causes:

  Legal hanging,
  Legal electrocution,
  Accident, injury, or *traumatism* (unqualified). [State **Means of injury.**]

(XIV.—Ill Defined Diseases.)

Note.—If physicians will familiarize themselves with the nature and purposes of the International List, and will coöperate with the registration authorities in giving additional information so that returns can be properly classified, the number of deaths compiled under this group will rapidly diminish, and the statistics will be more creditable to the office that compiles them and more useful to the medical profession and for sanitary purposes.

187. Ill defined organic diseases:

  Dropsy, [Name the disease of the heart, liver, or kidneys in which the dropsy occurred.]
  Ascites, etc.

188. *Sudden death.* [Give cause. Puerperal?]
189. Cause of death not specified or ill defined. [It may be extremely difficult or impossible to determine definitely the cause of death in some cases, even if a post-mortem be granted. If the physician is absolutely unable to satisfy himself in this respect, it is better for him to write **Unknown** than merely to guess at the cause. It will be helpful if he can specify a little further, as **Unknown** disease (which excludes external causes), or **Unknown chronic disease** (which excludes the acute infective diseases), etc. Even the ill defined causes included under this head are at least useful to a limited degree, and are preferable to no attempt at statement. Some of the old "chronics," which well-informed physicians are coming less

and less to use, are the following: *Asphyxia; Asthenia; Bilious fever; Cachexia; Catarrhal fever; Collapse; Coma; Congestion; Cyanosis; Debility; Delirium; Dentition; Dyspnœa; Exhaustion; Fever; Gastric fever; HEART FAILURE; Laparotomy; Marasmus; Paralysis of the heart; Surgical shock;* and *Teething*. In many cases so reported the physician could state the disease (not mere symptom or condition) causing death.]

LIST OF UNDESIRABLE TERMS.

As a result of the conferences between the Committee on Nomenclature and Classification of Diseases appointed by the American Medical Association with committees of other national medical organizations and with medical representatives of the Army, Navy, Public Health and Marine-Hospital Service, and the Bureau of the Census [1] it was agreed:

"That practical suggestions be framed relative to the reporting of causes of death and of sickness by physicians, and that a list of the most undesirable terms frequently employed be brought to their attention with the recommendation that they be disused."

In framing the following list of undesirable terms use has been made of the London Nomenclature, the Bellevue Nomenclature, and especially of the "Suggestions to Medical Practitioners respecting Certificates of Causes of Death," issued by the Registrar-General of England and Wales, and which constitutes a part of the book of "Forms for Medical Certificates of the Cause of Death" employed in that country.

UNDESIRABLE TERMS. (It is understood that the term criticised is in the *exact form* given below, *without further explanation or qualification.*)	REASON WHY UNDESIRABLE, AND SUGGESTION FOR MORE DEFINITE STATEMENT OF CAUSE OF DEATH.
"*Abscess*"	May be tuberculous, gonorrhœal, from appendicitis, etc., or relate to any part of the body. The return is worthless. State cause (in which case the fact of "abscess" may be quite unimportant) and location.
"*Accident*," "*Injury*," "*External causes*," "*Violence*." Also more specific	Impossible to classify satisfactorily. Always state (1) whether Accidental, Suicidal, or Homicidal;

1 Mortality Statistics, 1907, p. 19.

Undesirable Terms.	Reason Why Undesirable, and Suggestion for More Definite Statement of Cause of Death.
terms, as "*Drowning*," "*Gunshot*," which might be either accidental, suicidal, or homicidal.	and (2) **Means of injury** (e. g., Railroad accident). The lesion (e. g., Fracture of skull) may be added, but is of secondary importance for general mortality statistics.
"*Atrophy*," "*Debility*," "*Decline*," "*Exhaustion*," "*Inanition*," "*Weakness*," and other vague terms.	Frequently cover tuberculosis and other definite causes. Name the **disease causing** the condition.
"*Cancer*," "*Carcinoma*," "*Sarcoma*," etc.	In all cases the **organ or part first affected by cancer** should be specified.
"*Congestion*," "*Congestion of bowels*," "*Congestion of brain*," "*Congestion of kidneys*," "*Congestion of lungs*," etc.	Alone, the word "*congestion*" is worthless, and in combination it is almost equally undesirable. If the disease amounted to *inflammation*, use the proper term (pneumonia, nephritis, enteritis, etc.); merely passive congestion should not be reported as a cause of death when the primary disease can be ascertained.
"*Convulsions*"	"It is hoped that this indefinite term will henceforth be restricted to those cases in which the true cause of that *symptom* can not be ascertained. At present more than eleven per cent of the total deaths of infants under one year old are referred to '*convulsions*' merely."—*Registrar-General.* The Chicago Health Department refuses to accept this statement, and has entirely eliminated this indefinite return.
"*Croup*"	"*Croup*" is a most pernicious term from a public health point of view, is not contained in any form in the London or Bellevue Nomencla-

Undesirable Terms.	Reason Why Undesirable, and Suggestion for More Definite Statement of Cause of Death.
	tures, and should be entirely disused. Write **Diphtheria** when this disease is the cause of death.
"Dropsy"	*"Dropsy"* should never be returned as the cause of death without particulars as to its probable origin, e. g., in disease of the heart, liver, kidneys, etc."—*Registrar-General.* Name the disease causing (the *dropsy* and) death.
"Fracture," "Fracture of skull," etc.	Indefinite; the principle of classification for general mortality statistics is *not* the lesion but (1) the nature of the violence that produced it (**Accidental, Suicidal, Homicidal**), and (2) the **Means of injury.**
"Gastritis," "Acute indigestion."	Frequently worthless as a statement of the actual cause of death; the terms should not be loosely used to cover almost any fatal affection with irritation of stomach.
"Heart disease," "Heart trouble," even *"Organic heart trouble."*	Some cavil at the probable correctness of such returns, and it is better to state clearly the exact form of the cardiac affection, as **Mitral regurgitation, Aortic stenosis,** or even as **Valvular heart disease,** rather than to use the less precise language.
"Heart failure," "Cardiac weakness," "Cardiac asthenia," "Paralysis of the heart," etc.	*"Heart failure"* is a recognized synonym, even among the laity, for ignorance of the cause of death on the part of the physician. Such a return is forbidden by law in Connecticut; if the physician can make no more definite statement, it must be compiled among the class of ill defined diseases (*not* under Organic heart disease).

Undesirable Terms.	Reason Why Undesirable, and Suggestion for More Definite Statement of Cause of Death.
"Hæmorrhage," "Hæmoptysis."	Frequently mask tuberculosis or deaths from injuries (traumatic hæmorrhage), **Puerperal hæmorrhage**, or hæmorrhage after operation for various conditions. **Name the disease causing death in the course of which the "Hæmorrhage" was an incident.**
"Hydrocephalus"	"It is desirable that deaths from hydrocephalus of tuberculous origin should be definitely assigned in the certificate to **Tuberculous meningitis**, so as to distinguish them from deaths caused by simple inflammation or other disease of the brain or its membranes. **Congenital hydrocephalus** should always be returned as such."—*Registrar-General.*
"Hysterectomy"	*See* Operation.
"Infantile paralysis"	This term is sometimes used for paralysis of infants caused by instrumental delivery, etc. The importance of the disease in its present endemic and epidemic prevalence in the United States makes the exact and unmistakable expressions **Acute anterior poliomyelitis** or **Infantile paralysis (acute anterior poliomyelitis)** desirable.
"Inflammation"	Of what organ or part of the body? Cause?
"Laparotomy"	*See* Operation.
"Malignant," "Malignant disease."	Should be restricted to use as qualification for neoplasms; see Tumor.

Undesirable Terms.	Reason Why Undesirable, and Suggestion for More Definite Statement of Cause of Death.
"*Marasmus*"	This term covers a multitude of worthless returns, many of which could be made definite and useful by giving the name of the disease causing the "marasmus" or wasting. It has been dropped from the English Nomenclature since 1885 ("Marasmus, term no longer used"). The Bellevue Hospital Nomenclature also omits this term.
"*Meningitis,*" "*Cerebral meningitis,*" "*Cerebro-spinal meningitis,*" "*Spinal meningitis.*"	Only two terms should ever be used to report deaths from **Cerebro-spinal fever**, *synonym*, **Epidemic cerebrospinal meningitis**, and they should be written as above and in no other way. It matters not in the use of the latter term whether the disease be actually *epidemic* or not in the locality. A single sporadic case should be so reported. The first term (**Cerebro-spinal fever**) is preferable because there is no apparent objection to its use for any number of cases. No one can intelligently classify such returns as are given in the margin. Mere terminal or symptomatic meningitis should not be entered at all as a cause of death; name the disease in which it occurred. **Tuberculous meningitis** should be reported as such.
"*Natural causes*"	Coroners and justices of the peace may often be able to make a more definite return, although even this has value as eliminating external causes. What disease caused death?
"*Operation,*" "*Surgical operation,*" "*Surgical*	All these are entirely indefinite and unsatisfactory — unless the sur-

Undesirable Terms.	Reason Why Undesirable, and Suggestion for More Definite Statement of Cause of Death.
shock, *"Amputation," "Hysterectomy," "Laparotomy,"* etc.	geon desires his work to be held primarily responsible for the death; in which case, as in some certificates actually returned, he may facilitate understanding by signing his name as the cause of death! Name the **disease** or form of external violence **(Means of death; accidental, suicidal, or homicidal?).**
"Paralysis," "General paralysis," "Paresis," "General paresis," "Palsy," etc.	The vague use of these terms should be avoided, and the precise form stated, as **Acute ascending paralysis, Paralysis agitans, Bulbar paralysis,** etc. Write **General paralysis of the insane** in full, not omitting any part of the name; this is essential for satisfactory compilation of this cause. Distinguish **Paraplegia** and **Hemiplegia**; and in the latter, when a sequel of **Apoplexy** or **Cerebral hæmorrhage**, report the primary cause.
"Peritonitis"	"Whenever this condition occurs — either as a consequence of **Hernia, Perforating ulcer of the stomach** or **bowel [Typhoid fever?], Appendicitis,** or **Metritis (puerperal** or otherwise), or else as an extension of morbid processes from other organs [Name the **disease**], the fact should be mentioned in the certificate."—*Registrar-General.* Always specify **Puerperal peritonitis** in cases resulting from abortion, miscarriage, or labor at full term. When traumatic, report **means of injury** and whether **accidental, suicidal,** or **homicidal.**

Undesirable Terms.	Reason Why Undesirable, and Suggestion for More Definite Statement of Cause of Death.
"Pneumonia," "Typhoid pneumonia."	*"Pneumonia,"* without qualification, is indefinite; it should be clearly stated either as **Bronchopneumonia** or **Lobar pneumonia**. The terms **Croupous pneumonia** and **Lobular pneumonia** are also clear, and the London Nomenclature provides for the variety **Epidemic pneumonia**. "The term '*Typhoid pneumonia*' should never be employed, as it may mean either Enteric fever [**Typhoid fever**] with pulmonary complications, on the one hand, or Pneumonia with so-called typhoid symptoms on the other."—*Registrar-General.* When occurring in the course of or following a disease, the primary cause should be reported, as **Pneumonic typhoid, Plague (pneumonic form), Measles followed by bronchopneumonia, Influenza (pneumonia)**, etc. Do not report "*Hypostatic pneumonia*" or other mere terminal conditions as causes of death when the disease causing death can be ascertained.
"Ptomaine poisoning," "Autointoxication," "Toxæmia," etc.	These terms are used very loosely and it is impossible to compile statistics of value unless greater precision can be obtained. "Ptomaine poisoning" should be restricted to deaths resulting from the development of putrefactive alkaloids or other poisons in food, and the food should be named, as **Ptomaine poisoning (mussels)**, etc. Such terms should not be used when merely descriptive of symptoms or conditions arising in the course of diseases, but the

Undesirable Terms.	Reason Why Undesirable, and Suggestion for More Definite Statement of Cause of Death.
	disease causing death should alone be named.
"*Tabes mesenterica*," "*Tabes.*"	"The use of this term ["*Tabes mesenterica*"] to describe tuberculous disease of the peritonæum or intestines should be discontinued, as it is frequently used to denote various other wasting diseases which are not tuberculous. **Tuberculous peritonitis** is the better term to employ when the condition is due to tubercle."—*Registrar-General.* **Tabes dorsalis** should not be abbreviated to "*Tabes.*"
"*Tuberculosis*"	The organ or part of the body affected should always be stated, as **Tuberculosis of the lungs**, **Tuberculosis of the spine**, **Tuberculous meningitis**, **Acute general miliary tuberculosis**, etc.
"*Tumor*," "*Neoplasm*," "*New growth.*"	These terms should never be used without the qualifying words **Malignant**, **Nonmalignant**, or **Benign**. If malignant, they belong under **Cancer**, and should preferably be so reported, or under the more exact terms **Carcinoma**, **Sarcoma**, etc. In all cases the organ or part affected should be specified.
"*Uræmia*"	Name the disease causing death.

CHAPTER XXIV.

THE DISPOSAL OF THE DEAD.

Among all races of men and in all times, there have been special ceremonials connected with the disposal of the dead, and certain methods of disposal have been favored and others abhorred. They have been swathed in furs and blankets and placed on scaffolds as among our western Indians; exposed to have the flesh picked from the bones by vultures as among the Parsees of India; mummified with salt, saltpetre, spices and bitumen as in Egypt and Peru; burned on funeral pyres as in ancient Greece and modern India; buried in the earth permanently or temporarily until decomposition has removed the flesh; placed in vaults, rock tombs or mausoleums; deposited in the sea; covered with cairns; and most to the satisfaction of the sanitarian, in the most civilized nations, are with increasing frequency cremated in the rosy glow of the modern crematorium.

Almost all of these methods have one thing in common—a desire to remove the dead from the vicinity of the living because of a supposed malign influence which they might exert. Among uncivilized or superstitious communities, this malignant influence is attributed to ghosts; among enlightened peoples, to disease. How much there may be in this idea will be discussed in a later paragraph of this chapter.

As stated in the preceding chapter, a preliminary to any interment should be the presentation of a properly filled-out death certificate, and the giving of a formal permit by the accountable health officer or deputy. By this means the community assures itself that foul play has not been done, and in the case of infectious diseases of dangerous type, prevents a public funeral which would help to scatter the contagion.

In the United States, practically only three of the above mentioned methods of disposing of the dead are in use—burial in the ground, deposit in vaults, and cremation. Properly done, there is no sanitary objection to any of them. Cemeteries should not be

located where their drainage can contaminate a water supply, but aside from this, they may be located, in the absence of legal prohibition, anywhere. Vaults are at present only used for the temporary or permanent reception of embalmed bodies, enclosed in hermetically sealed caskets. The modern crematory furnace has about it nothing to offend any of the senses, the body being reduced to its constituent gases and a mere handful of ash within an hour or two. If there be any choice among these methods, it falls on the third for æsthetic and utilitarian reasons rather than for sanitary considerations. Rapid resolution of the body into its elements by fire is a much pleasanter thing to contemplate than slow destruction by the ordinary processes of decomposition, as all who have had to disinter bodies will agree; furthermore, cemeteries withdraw from cultivation land which becomes increasingly more needed with augmenting population.

Many states require a license for undertakers and embalmers, basing the right to license upon examination. This examination usually covers a rough knowledge of anatomy, the processes of embalming, something of infectious diseases, methods of disinfection of corpses and their preparation for burial or removal, and the legal phases of their work, besides strictly professional questions. This licensing of undertakers is a matter of importance, since it secures intelligent men for duties which are necessary for the public welfare. For this reason also, undertakers are frequently chosen as deputy health officers.

Dead bodies, before they can be received for shipment by rail, boat or express, must be furnished with a transportation permit, which is in the case of non-infectious diseases, on white paper, and of infectious diseases on colored paper. This transportation permit contains all the data on the burial permit, and is first signed by the attending physician or coroner, permission to remove the body is given by the health officer in the next-following section, and the undertaker certifies in the last section that the law relating to shipment of corpses has been fully complied with. The transportation is in duplicate, one half being carried by the person authorized to accompany the body or the express messenger, if shipment is by express, and the duplicate being forwarded by the carrying company to the State Board of Health. Railroads and express companies are required to make monthly reports to State Boards of Health, which places a check on the issuance of permits of this class

without a full compliance with the law. Indiana and some other states require a burial permit to accompany the transit permit, but in the case of bodies shipped in from other states allow the burial permit to be made out from the transportation papers, in the absence of a permit made out at the place of origin.

The rules of most State Boards of Health and the statutes of most states contain an absolute prohibition of the transportation of bodies dead of smallpox, Asiatic cholera, bubonic plague, typhus and yellow fever. In the case of at least two of these diseases, the prohibition is entirely unnecessary. Yellow fever is never, according to our present views of its etiology, contracted in any way except by the bite of a special mosquito, and Asiatic cholera is no more dangerous than typhoid fever, which is permitted to be transported. It is hard to see how either of the other three diseases can be disseminated through the medium of a dead body prepared as described in the next paragraph.

"The bodies of those who have died of diphtheria (membranous croup), scarlet fever (scarlatina, scarlet rash), glanders, anthrax or leprosy, shall not be accepted for transportation unless prepared for shipment by being thoroughly disinfected by (a) arterial and cavity infection with an approved disinfecting fluid, (b) disinfecting and stopping of all orifices with absorbent cotton, and (c) washing the body with the disinfectant, all of which must be done by an embalmer holding a certificate from the State Board of Embalmers. After being disinfected as above, such body shall be enveloped in a layer of cotton not less than one inch thick, completely wrapped in a sheet and bandaged and encased in an air-tight zinc, tin, copper, or lead-lined coffin or iron casket, all joints and seams hermetically soldered, and all enclosed in a strong, tight wooden box." *Rules of the Indiana State Board of Health.* As an alternative, the body disinfected and prepared as above may be placed in a coffin or casket, and this enclosed in the metallic case, which is afterwards soldered shut.

In the case of those dead of typhoid fever, puerperal fever, erysipelas, tuberculosis and measles, the rules are relaxed to allow transportation after preparation by cavity injection only, the washing, wrapping, and stopping of orifices being done as in the preceding paragraph, and the air-tight casket being also required.

Those dead of non-infectious diseases may be shipped in the

ordinary casket and rough-box, if properly embalmed by a licensed embalmer.

Since all of the modern embalming fluids contain such powerful antiseptics as formaldehyd, zinc chloride, mercuric chloride and alcohol, it is difficult to see why any germs of disease are not promptly destroyed, and in fact there is no reason to think they are not. There is but little reason also why any contagion should linger for more than a very few days around any corpse, since the bacteria of putrefaction will overgrow and destroy almost any of the pathogenic organisms except tetanus and anthrax.

Arsenical embalming fluids are almost everywhere forbidden, as making it possible to cover up arsenical poisoning when that drug has been given with homicidal intent.

CHAPTER XXV.

SCHOOL INSPECTION.

Importance.—When it is considered that from 5 to 7 hours of 5 days in the week for from 5 to 10 months in the year are obligatory in most states for every child between the ages of 6 and 14, the importance of a careful sanitary oversight of the schools becomes at once apparent. Modern civilization demands universal education, but this will rapidly become universal deterioration unless the waste of the health of the future fathers and mothers of the race, due to bad air, bad lighting, bad seating, overcrowding and the mingling of sick with well children are prevented.

These duties are sometimes undertaken by the health officer and sometimes by special medical inspectors of schools. Whoever is charged with these duties by law should be continually alive to his responsibilities and always on the alert to correct defects either in his charges or their environment. In childhood many conditions may be remedied or prevented that in adult life may gravely compromise the health or usefulness of the individual.

Buildings.—*Site.*—The site of a school building must be well-drained, either by nature or artificially; it must be convenient of access; it should not be near enough to railroads or noisy factories to allow the noise to interfere with work; it should have ample playground space; it should have some shade; the surface should be gravelled or turfed; walks must connect the schoolhouse with the street or road and with outhouses and water supply.

Foundation.—The foundation must be impervious to soil-water in order that capillarity may not dampen the walls. They should be of non-porous natural stone, hard-burned brick or concrete, and if of concrete, must have a layer of tarred felt, tarred paper or impervious stone or brick interposed between the foundation and the superstructure.

Basement.—If there is a basement, it should rise sufficiently high above the ground for light and air to penetrate to every part of it, and should never be allowed to become a dump for refuse of any

kind. If no basement is provided, the foundation walls should be pierced in appropriate places and guarded with gratings, in order to allow a circulation of air below the floors.

Cloak-rooms.—These must always be provided in order to avoid the stuffy and disagreeable odor of clothing in damp weather. In the country, shelves for dinner pails should also be provided.

Toilets.—These must be separate for the sexes, well screened, well painted or whitewashed, and kept clean. If water-closets are used, a type should be selected which can easily be scrubbed, and an automatic flush is desirable. Outdoor privies should take the type of those recommended in Chapter XXXI. Urinals must be placed in the toilets allotted to boys.

Wash Rooms.—It is patent that children should be afforded an opportunity and taught to use it, for cleansing the hands and face after play or visits to the toilet. For this, if piped water is available, the ordinary porcelain basins with run-off to the sewer connection should be installed. In case it is not available, ordinary granite or enamelled basins, with a water supply in buckets or tanks should be possible to any school. Paper towels or individual towels brought by the children must be used. The use of roller towels is an abomination.

Water Supply.—This is to be inspected according to the rules laid down in Chapter XXXVI. In many localities, the use of a windmill or gasoline engine will make possible a supply of water under pressure, using either an elevated tank or air-pressure basement tank for storage. This will provide not only water for drinking and washing, but for water-closets, the outflow from which can be purified by a septic tank before its final disposal.

Schoolrooms.—*Space.*—Not less than 225 cubic feet of space must be allotted to each person in the schoolroom, including the teacher. Rooms not affording this amount of space are overcrowded and transfers must be compelled until the condition is relieved. 12-foot ceilings are best for all purposes.

Ventilation.—Whatever means are used must provide for a complete change of air in 15 to 20 minutes. This is best tested by using a "bee-smoker" which fills the air with light smoke from burning rags, and if the air is completely clear in the time named, the ventilation may be regarded as satisfactory.

Three principal systems of ventilation are in use: the indirect, which utilizes differences of temperature between inside and out-

side air to cause an exchange between them; the *exhaust*, which draws out the air from the room, and the *plenum*, which forces air under pressure into it. The first system is the one in common use. The heat of a chimney, of hot air ducts, fireplaces or stoves, or appropriately placed steam-coils, heats the air in an outflow duct which rises and fresh air is drawn in through another duct to replace it. This system tends to break down as the weather begins to get warm, since there is not sufficient difference of temperature to secure the required circulation. The exhaust system supplies the necessary fresh air, but not all of it comes in through the inlet ducts, part of it being drawn in around doors and windows and creating unpleasant drafts. The plenum system, on the other hand, supplies more air than can be ejected through the outlets. The best method is found to be the use of two fans, one of which forces in slightly more air than the second or exhaust fan can remove. No matter what system is used, it will be of no value unless it will pass the smoke or similar test, and should be bought under a guarantee to change completely the air in a room within 15 to 20 minutes.

Heating.—Whatever system of heating is employed should maintain the temperature of every part of the schoolroom between 65° and 70° F., with a relative humidity of at least 40 per cent. Should the temperature fall below 60° the school must be dismissed at once. If stoves are used, they must be surrounded by screens so as to secure a better circulation of air and to protect the pupils who sit near. Steam heat should not be used for study rooms unless the air is heated by passing over steam coils in the inlet duct. Naked radiators are very undesirable in the study room, but are permissible for recitation, manual training, office rooms and halls. Many devices for using the heated air to secure ventilation are in use, but none should be permitted to be installed or used which fall short of the requirements stated in the next paragraph.

Humidity.—Some means, even if only the placing of pans of water on stoves or radiators, must be provided for adding to the moisture in the air. Cold air is robbed of its moisture, and reheating greatly increases its capacity for absorbing water vapor. Air that is too dry is unpleasant to breathe, and is necessary to be maintained at a higher temperature for comfort than moist air. Hence it is economy as well as good sanitation to humidify the atmosphere in some manner.

Light.—The room should be lighted from one side only, or by

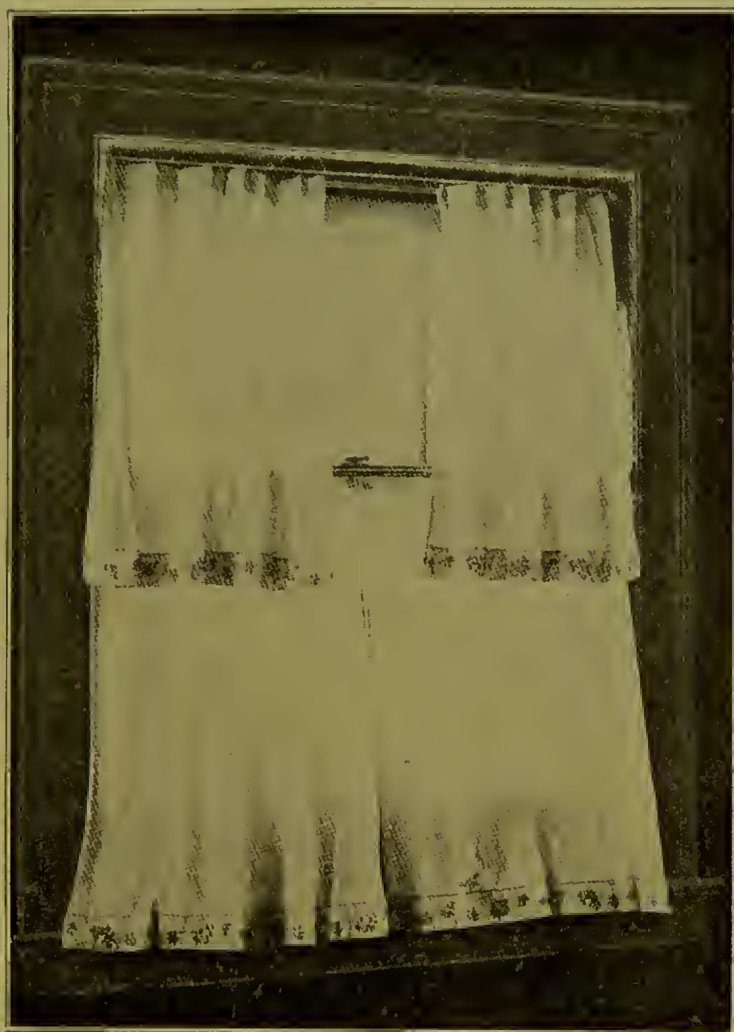

Fig. 10.—The Minnequa Window Curtain. (Courtesy, Dr. R. W. Corwin.)

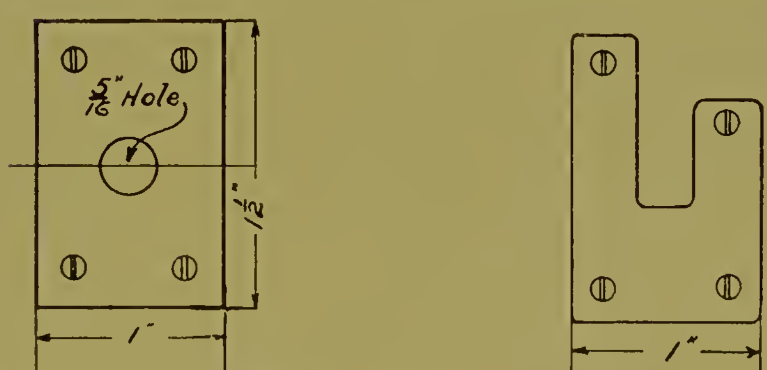

Fig. 11 —Simple wooden holder for curtain rods.

properly softened sky-lights, and the lighting area should not be less than one-sixth of the floor area. Prismatic glass in the upper sash is an advantage, since it diffuses the light to the opposite side of the room. Sash curtains like those shown in the cuts (Figures 10-11) are excellent additions to any window. They should be of washable material, with the rings which run on the rods attached permanently. It is not necessary to remove the rings for laundering. The device is the invention of Dr. R. W. Corwin, of Pueblo, Colorado. The walls should be a pleasant neutral tint of gray tinged with yellow, green, red or blue. They should never be a glaring white or brilliant color of any kind. A greenish gray is perhaps the easiest on the eyes, but except in sunny climates is apt to be a trifle depressing in general effect.

Seating.—Seats must be adjustable to the bodies of the children. It is nothing short of criminal to compel the child to adjust itself to the seat. Good work cannot be done by an uncomfortable child, and lasting eye-trouble or bodily deformity such as spinal curvature may come from the practice.

Blackboards.—These should be always dull-finished. A glossy blackboard is unnecessarily hard on the eyes. Blackboards and erasers should not be cleaned while school is in session, and erasers should be dusted outside. The chalk racks should be cleaned each evening by the janitor.

Arrangement of Buildings.—It is beyond the province of this book to detail the principles involved in all the various departments of school construction, but a very few salient points will be noted. Every school, in addition to the requirements before mentioned, must be so arranged that it can readily be emptied in case of fire. To this end doors must open outward and never be locked while school is in session, automatic checks being preferable to latches. Stairs must be broad and easy, or better, inclined planes or ramps be provided, thus making children of different heights equal in the matter of ascent and descent. (Figures 12-13-14.) If ground is not prohibitively high, the group system of arrangement is much to be preferred to the single building of two stories. A height of two stories should never be exceeded.

The subjoined plan for a grouped system of school buildings is suitable not only for small places but for township union schools, and besides the sanitary advantages which are obvious, provides a center for all the social activities of the surrounding country and

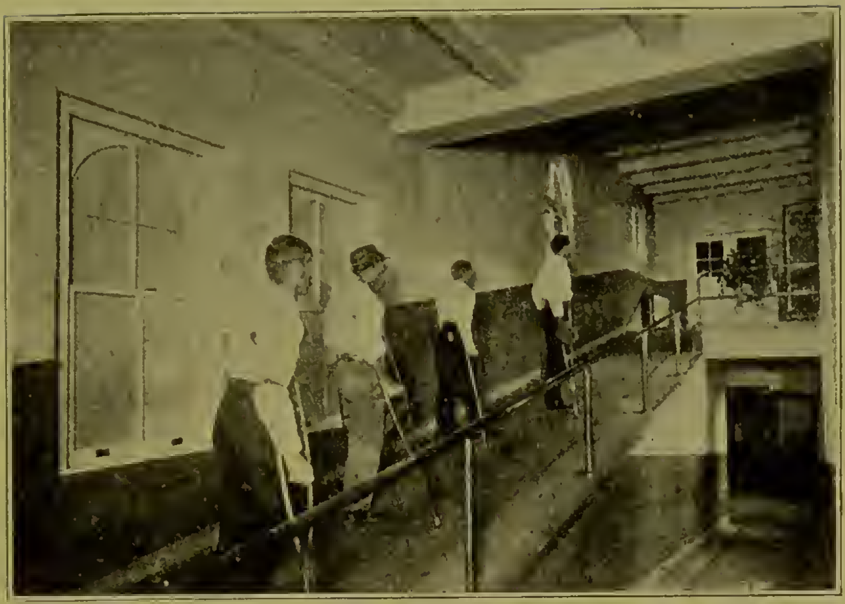

Fig. 12.—Patients on crutches ascending incline.

Fig. 13.—Man ascending fourteen-inch step. The child a seven-inch step. The angle at the knee is the same. In practice we make the three-foot child take the same step as the six-foot man.

Fig. 14.—Compare this photograph with that showing men on the incline in Fig. 12.

(Courtesy, Dr. R. W. Corwin.)

permits adequate supervision of the school work and the condition of health of the children.

Care of Buildings.—Floors may be oiled with a small amount of floor dressing. Large amounts hinder ready cleaning by binding the dirt. Dry sweeping and dusting should be absolutely prohibited, and sweeping and dusting of corridors should not be permitted while school is in session. Oiled sawdust is a good allayer of dust and is prepared by dissolving a teacupful of floor oil in a quart of gasoline and thoroughly and quickly mixing it with as much sawdust as will absorb it cleanly. Oiled dustcloths are made by adding an ounce of floor oil to a quart of gasoline and wringing cloths, which are best yard-square pieces of cheese cloth, out of the liquid. These are allowed to dry and may be washed when necessary. On account of the inflammability of the gasoline, it is necessary that these operations be conducted out of doors. If electric power is available, the use of a vacuum cleaner is a great convenience and a sanitary device to be commended. Buildings should be scrubbed out at least weekly on Friday evenings, and before the beginning of the school year should have a most thorough cleaning, to which many states add a disinfection by sulphur, formaldehyd or a liquid disinfectant applied with mop and spray.

Inspection.—A schedule for building inspections is found in the Appendix.

Teachers and Janitors.—No teacher or janitor should be employed who is suffering from any disease which would debar a child from the school. This is especially true of tuberculosis and syphilis, and school medical inspectors and health officers must instantly require the resignation of any person employed in the schools who is suffering from these diseases.

Pupils.—The medical inspection of schools in this country dates back only 20 years, but in Great Britain and Germany has a much earlier origin. It is now required in many states in some or all of the schools, and is one of the most important, if not the most important, branches of sanitary work. The Indiana rules, which are most recently revised, and which are free from unnecessary red tape are appended. The inspector should bear in mind that no amount of routine work will take the place of intelligent examination of the children, and should strive to make and keep his records complete.

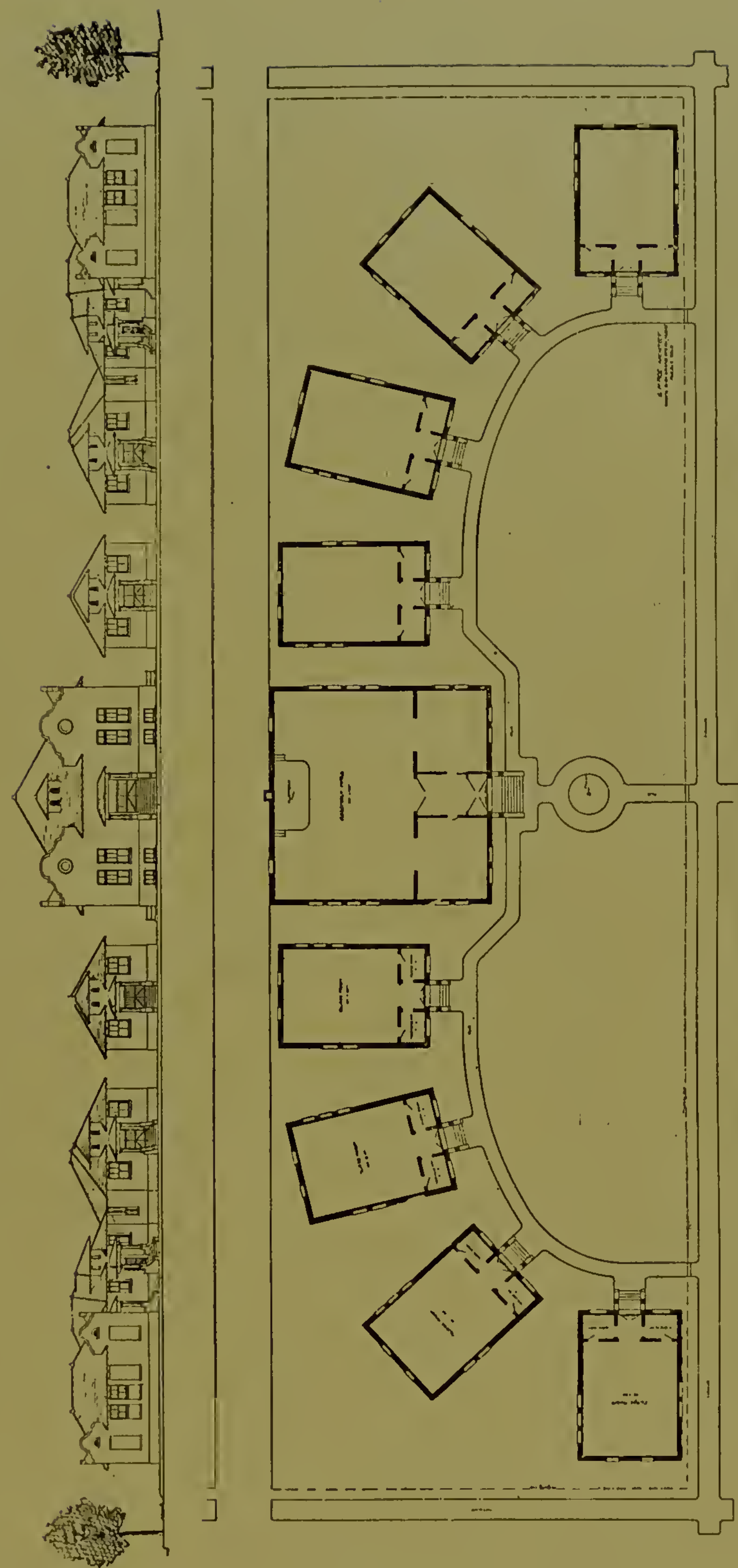

Fig. 15.—Plan of an inexpensive eight-room school. (Courtesy, Dr. R. W. Corwin.)

Physician's Duties.

Sec. 4. School physicians shall make prompt examination and diagnosis of all children referred to them and such further examination of teachers, janitors and school buildings as in their opinion the protection of the health of the pupils and teachers may require. Whenever a school child is found to be ill or suffering from any physical defect, the school physician shall promptly send it home, with a note to parents or guardians, briefly setting forth the discovered facts, and advising that the family physician be consulted. If the parents or guardians are so poor as to be unable to give the relief that is necessary, then school trustees and township trustees, as the case may be, shall provide the necessary relief: Provided, That in cities where public dispensaries exist the relief shall be given by said dispensaries. School physicians shall keep accurate card-index records of all examinations, and said records, that they may be uniform throughout the State, shall be according to the form prescribed by the rules authorized in this act, and the method and manner of reports to be made shall be according to said rules: Provided, however, that if the parents or guardian of any school child shall at the beginning of the school year furnish the written certificate of any reputable physician that the child has been examined and parents notified of the results of such examination in such cases the services of the medical inspector herein provided shall be dispensed with, and such certificate shall be furnished by such parent or guardian from time to time, as required by the trustee or board of trustees having charge of such schools. [From the Indiana School Inspection Law of 1911.]

Rules for Medical School Inspection.

The School Physician.

Rule 1. It shall be the duty of the school physician to examine all school children as soon as practicable after their first admission to school. This examination shall take note of said children as to cleanliness, obvious physical defects, as physical deformities, condition of nose and throat, and teeth, ear discharges, squints, general fitness for school life and previous medical history. Measurement of height and weight shall be recorded. This first examination shall be conducted in the presence of the parents or family physician, if so desired. (Provided, that any child presenting a certificate of examination as provided in the medical inspection law, shall be exempt from the school physician's examination.) A permanent record of all such examinations shall be kept on blanks, according to form prescribed by the State board of education and State board of health. Such records to be subject to inspection by the public only on an order from the school physician.

Rule 2. It shall be the duty of the school physician to make an examination of all children referred to him by teachers. Such examination to consist of whatever may be necessary to determine whether or not the child should be excluded from school. Such examination shall be made in the presence of the parents if so desired. In all matters pertaining to exclusion from school the decision of the school physician shall be final. A record shall be kept of all such examinations on forms shown in this manual, to be provided by the

school authorities, a copy of which shall be furnished the parents or guardian of said children.

Rule 3. It shall be the duty of the school physician to make a general examination of all the children in the public schools at least once a year for any defect or disability tending to interfere with their school work, and a special examination of children (a) who show signs of being in ill health or of suffering from infectious or contagious diseases (b) who are returning to school after absence on account of illness or from unknown cause.

Rule 4. It shall be the duty of the school physician to make such examinations of teachers, janitors and school buildings as in his opinion the protection of the health of the pupils may require.

Rules for Teachers.

The teachers in all the public and parochial schools of the State of Indiana shall test the sight and hearing of all school children under their charge, once in each school year, and at such other times as may be necessary. The sight test shall be made by the use of the Snellen's Test Type Chart and the hearing test shall be the watch test or the whisper test, preferably the whisper test. An individual record shall be kept of said test and whenever a defeet of vision or hearing is noted the case *shall be referred to the school physician.* Teachers and school offieials shall rigorously exclude from school all children specified in any notiee of exclusion issued either by the school physician or by the local health officer until sueh children shall present a certifieate of admission from the school physician or the health officer.

Rules for Testing Eyesight.

Rule 1. The annual test for eyesight and hearing shall be made as early in the sehool year as possible, preferably in September. Individual pupils may be tested at any time that a test is considered necessary.

Rule 2. All tests shall be made as nearly as possible under the same conditions and shall be supervised by the principal or superintendent, in order to see that the conditions of the test are uniform as far as possible for the different classes.

Rule 3. Do not expose the test type chart except when in use, as familiarity with the chart leads children to learn the letters "by heart." Children should be examined singly.

Rule 4. Test each eye separately. Have the pupil begin at the top of the test card and read down as far as he can, first with one eye and then with the other. Hold a card over one eye while the other is being examined, but do not press on the covered eye, as pressure may produce an incorrect examination.

Rule 5. Place the test chart on the wall in a good light at about the level of the pupil's head and at a measured distance of 20 feet from the pupil. The chart should have a good side illumination and not hang in range of a window, which will dazzle the eyes.

Rule 6. Children wearing glasses shall be tested with the glasses properly adjusted, and if sight is found normal with the glasses it shall be recorded as normal.

Rule 7. Record as defeetive only those whose vision is 10/20 or less in either eye.

Rule 8. Where the child cannot name the individual letters, although able to read, the chart figures may be used. If the child does not know figures or letters, use the chart of inverted E's, asking the child to tell by the movement of the hand the side on which there is an opening on the E's, i. e., up, down, right or left.

Rule 9. The lines on the chart are numbered to indicate the distance the respective letters should be read by the normal eye. The record is made by a fraction, of which the numerator represents the distance of the chart from the child and the denominator the lowest line he can correctly read. Thus, if at 20 feet the pupil reads the line marked 20 feet, the vision is 20/20 or normal. If he only reads correctly the line above marked 30 feet, his vision is 20/30 or 2/3 normal. If at a distance of 20 feet the pupil can only read correctly the line marked 40 feet, the vision is 20/40 or 10/20, which must be recorded as defective.

If a pupil cannot read the largest letters he must go slowly toward the chart until he can. The distance he is from the chart when he can read the largest letters will be the numerator and 200 the denominator.

Rule 10. Report to the State board of health the total number of children examined and the number found defective in eyesight and hearing by test.

Method of Testing Hearing.

The person conducting the test should be possessed of normal hearing. The examination should be conducted in a room not less than 25 feet long and situated in as quiet a place as possible. The floor should be marked with parallel lines, one foot apart and numbered. The child should sit in a revolving chair in the first space. Examination should be made with the whisper or spoken voice. The child should repeat what he hears and the distance at which words can be heard distinctly should be noted. The two ears should be tested separately. The test words may consist of numbers from one to one hundred and short sentence. It is best that but one pupil at a time be allowed in the room, to avoid imitation. The standard to be adopted is as follows: In a still room the standard whisper can be heard easily at 25 feet. The whisper of a low voice can be heard from 35 to 45 feet and of a loud voice 50 or 60 feet.

In the watch test the ticking of a watch is used instead of the voice. The watch test, however, cannot be depended upon for the reason that children when asked if they hear the ticking of a watch will answer, "Yes," when in fact they do not hear the watch. For this reason the whisper test should be used.

Blank Forms.

The following blank forms are recommended for use in connection with the institution of school inspection, in order that the system of supervision and records may be uniform wherever medical inspection is established throughout the State. Additional blanks and forms may be added by school officials to meet local conditions, or as the scope of medical supervision may be enlarged. The forms herein given will be found essential and are to be adopted as the basis of record wherever medical inspection is instituted.

SCHOLARSHIP AND PHYSICAL RECORD.

No 1

DEPARTMENT OF SCHOOL HYGIENE.

Physical Record.

CITY SCHOOLS ....

HEALTH RECORD OF   SEX: M.-F. BORN:

ADDRESS   History of Rheumatism   Measles   Scarlatina

Diphtheria   Varicella   Pertussis   Pneumonia   Mumps   Grippe

SCHOOL YEAR	1		2		3		4		5		6		7		8		9	
EXAMINATION AND RESULTS	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R
DATES																		
General Appearance																		
Nutrition																		
Flat Foot																		
Eyes																		
Ears																		
Nose																		
Throat																		
Teeth																		
Skin																		
Heart																		
Lungs																		
Neck Glands																		
Vaccination																		
Height																		
Weight																		

NOTE

† = Normal   C. = Corrected
— = Not normal   N. = Not corrected
⌣ = Examination   R = Result.
P C = Partially corrected

REMARKS

For details see other side

No. 2.

DEPARTMENT OF SCHOOL HYGIENE.

Scholarship Record.

CITY SCHOOLS OF ....

Name	Date of Birth	Place of Birth	Parent	Parent's Occupation
Address	Address	Address	Date of Leaving School	Father's Nationality
1	4	7		
2	5	8	Cause of Leaving School	Mother's Nationality
3	6	9		

School Year	First Term						Second Term					
	School	Grade	Date Entered	Weeks Enrolled	Attendance	Scholarship	School	Grade	Date Entered	Weeks Enrolled	Attendance	Scholarship

For details see other side.

No. 3.

NOTE TO SCHOOL INSPECTOR.

Name ....

Residence ....

School ....

Please examine this pupil for

....*Teacher.*

When out of Blanks notify..

No. 4.

SCHOOL HEALTH DEPARTMENT. ....19...

TO THE PARENT OR GUARDIAN OF

....

It is my duty to report to you the result of an examination of the above named.

....

....

....

You are advised to take............*to a physician for further advice and treatment. Be sure and*

TAKE THIS PAPER TO THE DOCTOR.

....

Medical Inspector of Schools.

No. 5.

.... SCHOOL. ....19...

TO THE PARENT OR GUARDIAN.

....................................*was sent home from school because*

the child's body was not clean,

the head was not clean,

the clothes were not clean.

The child must not be sent back to school until clean.

....*Principal.*

No. 6.

DEPARTMENT OF SCHOOL INSPECTION.

......................PUBLIC SCHOOLS. ....19...

Principal:

Admit ....

....

....

Medical Inspector.

SCHOOL HEALTH DEPARTMENT. ....19...

TO THE PARENT OR GUARDIAN

of ....

It is my duty to report to you that

....

has been examined by the school inspector—or dentist—and that ....
teeth need cleaning—treatment—filling.

PLEASE SECURE COMPETENT DENTAL ADVICE AT ONCE.

....*Teacher.*

SCHOOL HEALTH DEPARTMENT. ....19...

NOTICE TO PARENT OR GUARDIAN.

You are hereby notified that

....

has been examined by the school inspector and found to have symptoms of ....

PLEASE SECURE COMPETENT MEDICAL ADVICE AT ONCE.

....*Teacher.*

SCHOOL HEALTH DEPARTMENT. ....19...

NOTICE TO PARENT OR GUARDIAN.

You are hereby notified that the school examination of

....

shows some trouble with the *ears* / *eyes* *which needs competent medical advice.*

PLEASE ATTEND TO THIS AT ONCE.

....*Teacher.*

No. 7.

SIGHT AND HEARING TESTS.

NAME .... SCHOOL ....

DATE	Grade	EYESIGHT		Notice Sent	HEARING		Notice Sent	Remarks
		Right	Left		Right	Left		

CHAPTER XXVI.

FACTORIES AND WORKSHOPS.

This subject may or may not form an important part of the health officer's work, accordingly as his duties are defined under the statutes of his particular state. Irrespective of the visits of state factory inspectors, there are many things which can be better attended to by the health officer himself, since he is or should be always on duty. For those who desire to make complete inspections of manufacturing plants, a schedule of inspection will be found in the Appendix. In the limited space which can be alloted to the subject in a work of this kind, it will only be possible to indicate the more salient points for investigation.

Building.—This should be well-lighted, well-ventilated; provided with outward-opening doors; fire-escapes if more than two stories in height; have a water supply for drinking and toilet, as well as for fire extinguishing; have an ample cubic space for each worker. Seats must be provided for women workers and separate toilets for men and women.

Lighting.—The easiest way to judge of the lighting of a building is to use the Snellen test cards. If a given line only can be read, while the observer is able to read the normal in proper light, then the light is defective just that much. For example, if the inspector reads in a good light the 20 foot line at that distance, but is compelled to go to a distance of 15 feet to read it in the factory, the light is deficient 5/20 or 1/4. This may be due to insufficient window space or it may be due to dirt on the glass. In any case it is to be corrected because it is conducive to diseases—especially tuberculosis, increases the liability to accidents, and is ruinous to the eyes of operators doing fine work.

Ventilation.—With a mill in operation, the smoke test or the use of essential oils is out of the question, but fortunately it will then be unnecessary. Any place which is free from foul odors and dust is well-ventilated, but an inspection of outlet ducts, and force- or exhaust-fans will enable a good idea to be formed of their efficiency.

Obstructions in ventilators should always be looked for. The amount of dust in the atmosphere may be ascertained with considerable accuracy by exposing a glass plate covered with glycerine for ten minutes and then counting the number of dust specks with a linen tester in a good light. The linen tester is an inexpensive lens having an opening of either one-fourth or one-half inch square, which gives a convenient field for this kind of work. Buildings having metallic dust, especially lead, must be particularly well-ventilated. Those having grain-dust, cotton fibers, fine sawdust and so on, are subject to explosions which may be very destructive. All forms of dust if present in quantity are dangerous to health and should be abolished if possible.

Cubic Space.—The amount of cubic space per worker should never be under the 250 cubic feet allowed by the British Factory Act, and in textile and other dusty trades should be at least double. In figuring space, the amount taken up by machinery should be deducted.

Stairs and Fire Escapes.—These should be ample to allow the emptying of the factory within 2 or 3 minutes, even if a part of the exits should be cut off. In large buildings a central lengthwise partition of fireproof material, pierced with fire-proof doors, enables a quick escape to the half of the building which is not in danger, whence the street may be reached at leisure. Elevators should not be counted in as fire-escapes, since elevator shafts are frequently the very means by which fire is drawn to upper stories.

Machinery.—All belts, line shafts, wheels, pulleys and other moving parts must be guarded so as to be as nearly "foolproof" as possible. So also should chutes, elevator shafts and trapdoors be protected.

Toilets and Washrooms.—Toilets and washrooms should be provided for each sex, and should be properly plumbed with open plumbing, kept in good order, and the washroom supplied with hot and cold water, soap and individual towels. Roller towels are too frequently a means for the transmission of disease. If cotton towels are used, they may have a metallic eyelet which threads on an arched rod which is locked, and which allows clean towels to be taken from the supply on top and after use, to be dropped into a receptacle for the soiled towels below, still remaining on the arch-rod. Or at an expense less than that of laundry, paper towels can be provided, and burned after use. In many industries, shower

baths and rest rooms would greatly add to the efficiency of the workers, and in some places are provided. If they are in use, they should be inspected also.

Employees.—A rather cursory examination will determine how thoroughly it is necessary to go into the subject of occupational diseases. If an old-established factory has no employees who have worked more than a few years, or if all who have worked more than a few months show evidence of being out of health, the whole establishment should be gone over to determine the cause.

There is not sufficient available space to go thoroughly into the subject of occupational diseases, but the following facts should be borne in mind:

Dusty Occupations as found in flour mills, cement factories, textile mills, grinding establishments and similar places, are prone to cause the development of tuberculosis in the workers.

Metallic Fumes, causing acute or chronic poisoning, are associated with zinc, brass, bronze and copper smelting; lead working; mercury works, such as mirror factories, amalgamation plants and fire-gilding establishments. The dust of these metals also acts as do the fumes.

Non-metallic Fumes and Dust which are also associated with specific poisonings, are to be guarded against in the reduction and smelting of the precious metals (arsenic, sulphur and its compounds, tellurium and its compounds, cyanogen compounds); phosphorus works and match factories employing white phosphorus; chemical works and dyeing establishments. Chronic chromium poisoning may be caused by the chromic acid or chromates used in chrome tanning.

Methods.

The safest plan for the inexpert investigator to employ is to investigate on general principles, using his eyes and ears and any local knowledge he may possess, questioning the workers under seal of confidence when out of the factory, reading any reports or text-books on the special industry under investigation, and finally calling on his State Board of Health or factory inspection or both for assistance. By so doing he will be of most value to the central authority and will know what instructions to ask and what course to pursue in asking assistance or authority.

The subject of occupational diseases is exceedingly important to

the state and it will be a comparatively easy thing for the health officer to qualify to handle the vocational disabilities found in his territory and thus greatly extend his usefulness. On the other hand, to qualify as an expert in all the occupational diseases requires years of study and observation as well as most exceptional opportunities. For this reason, the health officer is urged to take every chance to get information on the disabilities attending trades and manufactures in his own district rather than to attempt to cover occupations not represented in his territory.

CHAPTER XXVII.

INSTITUTIONS AND PRISONS.

Since people are confined in institutions and prisons for long periods without opportunity to see the outside world, and since many of these people are mentally or physically ill, the asylum, prison or jail must be kept clean, light and well ventilated. No defects of construction can excuse or condone lack of cleanliness, and if construction is so utterly bad that cleanliness, fresh air and ventilation are impossible, then steps must be taken for condemnation of the unfit building and its replacement by a new and decent one. The excellent schedule of the New Jersey Board of Health which is printed in full in the Appendix will suggest all necessary details in the inspection of such places, only general standards finding a place in this chapter.

Site.—The site of any public charity or penal institution should be chosen on well-drained soil, the drainage being either natural or artificial or both. This soil should not be allowed to become polluted by refuse or filth of any kind and if the pollution has already occurred it should be remedied as far as possible by removing all removable filth and stopping questionable means of disposing of it for the future.

Water Supply.—The water supply should be the best procurable. Wells, unless drilled through impermeable rocks, are always suspicious and if used must be frequently examined chemically and bacteriologically. Cisterns, if tight and properly cared for are always safe against anything but wilful pollution. A good public water supply is best, since it gives water under pressure at all times, although the same advantages can be obtained anywhere by the use of power-pump and tank. It should be sufficient to allow frequent bathing and afford a good potable water.

Buildings.—These should be well-lighted, because light reveals dirt; well ventilated and airy, and have not less than 750 cubic feet of space for each inmate, 1,000 cubic feet being a better and more humane allowance. Temporary crowding below this require-

ment should never be allowed to become permanent. Inspection made with the schedule above mentioned in hand will reveal any faults in the building.

Plumbing and Drainage.—Storm-water and sewer connections must be separate. If there is no sewer connected with the institution, sewage and slops must be disposed of according to the principles laid down in Chapters XXXI and XXXII, while garbage is cared for as in Chapter XXXIII. Baths of some kind must be installed. The shower or rain bath is most easily cared for, most effective and most economical of water.

Ventilation and Heating.—The health officer will be able to decide these questions for himself, always bearing in mind that the "jail smell" or "institutional odor" is an evidence of bad ventilation or poorly enforced bathing regulations, or both.

Inmates.—The inmates, whether the institution is large or small, should be divided not only as to sex, but as to age. Old and hardened criminals and young persons just entering on a career of crime should never be confined together, or the demented placed in with criminals.

There should be provision for the segregation of those entering for a few days, until it can be ascertained whether they are suffering from vermin or infectious diseases. An isolation ward is an important part of every public institution of any size, and even the smallest should have a separate room with one or two beds for that purpose. It is an excellent rule to require vaccination at once of everyone committed to a public institution or prison.

Exercise is an important part of the discipline of any place of this kind, and a place, if possible in the open air, otherwise in well ventilated corridors, must be provided. Unless there are grave reasons against it, writing materials and reading matter should be allowed and if the prisoners or patients are permitted to be together for recreation at any time, cards and other harmless games are permissible.

The inmates should be inspected as to cleanliness at least twice weekly, and better daily by the physician or a disciplinary officer.

Infectious Diseases.—These are always to be handled on general principles, isolation, disinfection and immunization where that is possible.

Police.—Those measures taken to insure cleanliness of any building or grounds are in military parlance "police duty." The polic-

ing should be done every day in the year, rain or shine, especially if done by the inmates. In addition to the daily police, whitewashing should be done frequently enough to keep all surfaces spotless, and scrubbing at least twice a week should keep all floors and woodwork in perfect order. Inmates who wilfully make dirt or commit nuisances should be compelled to clean up the dirt and may be further punished by deprivation of some privilege for a time. In making inspections one should always look into dark corners which may conceal sweepings, scraps of food, tobacco quids and spittle.

Food.—The only way to know what the inmates actually get is to be present in the wards at meal-time. To see how it is prepared, visit the kitchen. The ration should be plain, well-cooked and sufficient. Unless the inmates are employed in some manner, the ration should be less than for people at work. Delicacies are out of place except for the sick, the aged, and on Sundays and holidays.

Opportunity.—The institutional or jail physician has an opportunity to do more than the ordinary sanitary work and by careful study of his patients and charges may do more than anyone else toward reclaiming them toward useful lives.

CHAPTER XXVIII.

THE RAT.

Sanitary Importance.—The rat is of importance to sanitarians because of its agency in the transmission of bubonic plague, and no text-book of sanitation can be considered complete which does not give attention to the rat and the best means of destroying it. Slaughter-house rats are also the chief means of infecting hogs with *trichinosis,* a disease of considerable importance.

Species.—The common rat is the brown or Norway rat (*Mus norvegicus*), though two others, the black rat (*Mus rattus*) and the roof rat (*Mus alexandrinus*) are found in the United States. All of these are accidentally introduced denizens of the Old World, the last named two being first introduced, and being driven out by the hardier and stronger brown rat, which is, next to man and the dog, the most cosmopolitan of all mammals.

The rat occasions an annual economic loss by destruction of property amounting to many millions of dollars in the United States alone. With this loss, as sanitarians, we have nothing to do, but of course the methods noted in the following pages have equal value for anyone wishing to destroy rats, whether for sanitary or economic reasons. They are condensed from Farmers' Bulletin No. 369, of the United States Department of Agriculture, which is the work of Mr. David E. Lantz, of the Biological Survey. Those who wish a fuller account of the rat than is here possible will do well to procure this bulletin.

The first consideration in a warfare on rats is collective action by the entire community. Action by individuals, while it destroys a small portion of the rat population, simply results in driving them to new haunts for a time, to return later in their original numbers. Intermittent persecution has bred in the rat a high degree of intelligence and cunning which make anything but well-concerted plans of little force.

Rat-proof Building.—The most important means of repressing rats is to deprive them of safe breeding places. This is best done

by the free use of concrete in foundations, in cellar floors, around drain pipes, and wherever rats are likely to try to find an entrance. For this purpose a medium rather than a lean concrete should be used. The use of concrete between lath and weather-boarding in frame houses, to the height of a foot, will prevent them from getting in except through open doors and windows. Old rat holes can be stopped up with a mixture of concrete and broken glass or crockery. Basement windows must be screened. Inner doors, forming a vestibule are a safeguard, and outer doors, particularly to markets and groceries, should be guarded with pieces of thin metal to prevent rats from gnawing through at night.

Concrete should replace brick or wood for porch and area floors, and stables, barns and granaries should be of the same material. In the actual or threatened presence of bubonic plague, it is necessary to compel the tearing down of all old buildings which can harbor rats, as under such circumstances they become dangerous nuisances.

Where concrete floors are used in horse- and cow-stables, they may be covered with wood, in order to prevent the chilling contact of the first material, and where it is used for the floors of poultry houses, it may be covered with dry earth or sand. It must be emphasized that every rat destroys property on an average of something like a dollar a year, and that the man who has no rats on his premises is the gainer by the fact. As concrete is now as cheap as or cheaper than wood for many purposes, its use should be encouraged as far as possible.

Starving Out Rats.—Rats are the most omnivorous of all animals, and while it is important for economic reasons to keep food intended for consumption by man or domestic animals away from rats, it is equally important to destroy garbage so that they cannot live on it in the interim between their attacks on really valuable stores. If garbage is handled as described in the chapter on the subject, rats will not be able to get at it. To the extent that their food supply is cut off, their reproduction is limited. Wherever possible, the collection of garbage and its disposition should be done by the municipality, and everywhere it should be a matter of care that no rats get access to it either before or after collection. Country slaughter-houses are probably the worst offenders in this regard, the rats being treated like beneficent scavengers. In factories, the remains of lunches should be carefully collected into

metal receptacles and afterwards burned, as hungry rats are more easily trapped than well-fed ones.

Wire netting, of heavy half-inch mesh, placed around the outside of iceboxes, cooling-rooms and similar places, renders them entirely rat-proof. Strips of thin metal on all the angles of boxes prevent rats from gaining entrance, since they never attempt to enter from a plane surface, but always from a salient angle.

Natural Enemies of Rats.—The most important natural enemies of the rat are the larger hawks and owls, skunks, foxes, coyotes, weasels, minks, dogs, cats and ferrets.

Whenever the farmer or the sportsman is tempted to destroy one of the predatory animals named above, he should consider that the occasional chicken or game-bird taken by them is far out-weighed by the number of rats they destroy, the rats in turn destroying more eggs, game and poultry than all of these agencies combined, to say nothing of the other property they injure and destroy.

Traps.—The traps figured are those found to be most effective by the Biological Survey. Owing to their cunning, rats are hard to trap in large numbers and for long periods of time, especially if food is abundant; but properly handled, traps are one of the most effective means of reducing their numbers.

Guillotine Traps.—For general use these traps (Figure 16) are probably best, since they occupy little space, and may be used with bait; or unbaited, set in runs or against rat-holes. The simplest designs, and those made of metal, are best, on account of superior durability and less capacity to absorb odors. Fried sausage or bacon is one of the best baits, and part of an ear of corn, if other grains are not stored near, makes a good bait. The trigger wire should be bent back, as shown in cut, so that the released spring will strike the rat squarely across the neck.

Other good baits are oatmeal, toasted cheese, buttered toast, fish, fish offal, fresh liver, raw meat, pine nuts, apples, carrots, corn, and sunflower, squash or pumpkin seeds. Broken fresh eggs are always effective, and fresh vegetables are very tempting to rats in winter. When seed or meal is used with this kind of trap, it is sprinkled on the trigger plate, or if the trap is unprovided with a plate, the trigger wire is bent outward and the bait placed underneath.

Cage Traps.—If rats are numerous, the cage trap if of heavy wire and well reënforced, can be used to advantage. Lightly constructed cage traps allow the rat to force his way out between the

wires. They should be baited and left open for several nights, until the rats are accustomed to enter to obtain food. They should then be closed and baited, when a large catch may be expected—especially of young rats. As many as 25 rats and even more have been taken at a time in these traps.

It is sometimes a good idea to place cage traps under a bunch of hay or straw, and to place a decoy rat in the trap is often useful. Another good idea is to put the opening of the trap to the inside of a rat-hole in a large packing case, the case then being filled with trash.

Cage traps, notwithstanding occasional large catches, are less effective in the long run than guillotine traps.

Figure-4 Trigger Trap.—This type of trap is familiar to every boy who has lived in the country, and the principle is applicable either to the box or deadfall of flat stone or weighted plank. In the latter form it will sometimes take a wise old rat who refuses to enter the more modern forms of trap.

Steel Trap.—The steel trap (No. 0 or 1) may sometimes be used, but as the animal may be caught by the foot and not killed, its squealing may frighten away other rats temporarily. It may be set in a shallow pan and covered with bran or oats, taking care that the bait does not get under the trigger pan. This may be prevented by placing a very light piece of cotton underneath the trigger, and setting as lightly as possible. In narrow runs an unbaited steel trap, covered with tissue paper or thin cloth is sometimes good.

To be effective, the bait must always be of a kind not readily to be procured by rats; in a feed store or granary, use meat; in a meat market, grain or vegetables. The bait must be kept fresh and attractive, and no other store of the kind used must be accessible.

Barrel Traps.—These traps are easily made by covering a headless barrel with coarse brown paper and baiting for several nights. A cross is then cut in the paper, and the bait secured by gluing or tying so that the bait will not follow the rat into the barrel. As many as 3,000 rats have been caught in such traps in a single warehouse in one night. A similar trap consists of a barrel with a light hinged cover, so weighted as to swing back to the horizontal after the rat has been dropped into the barrel. Both plans are shown in Figure 17.

Pit Traps.—These are illustrated in Figure 18, and consist of

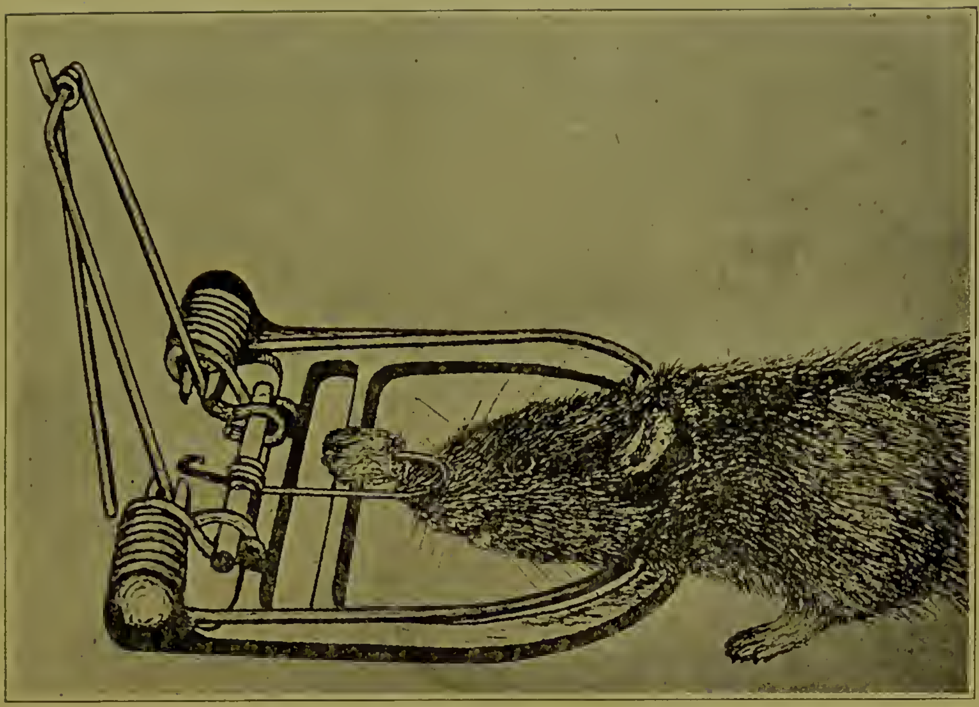

Fig. 16.—Method of baiting guillotine trap.

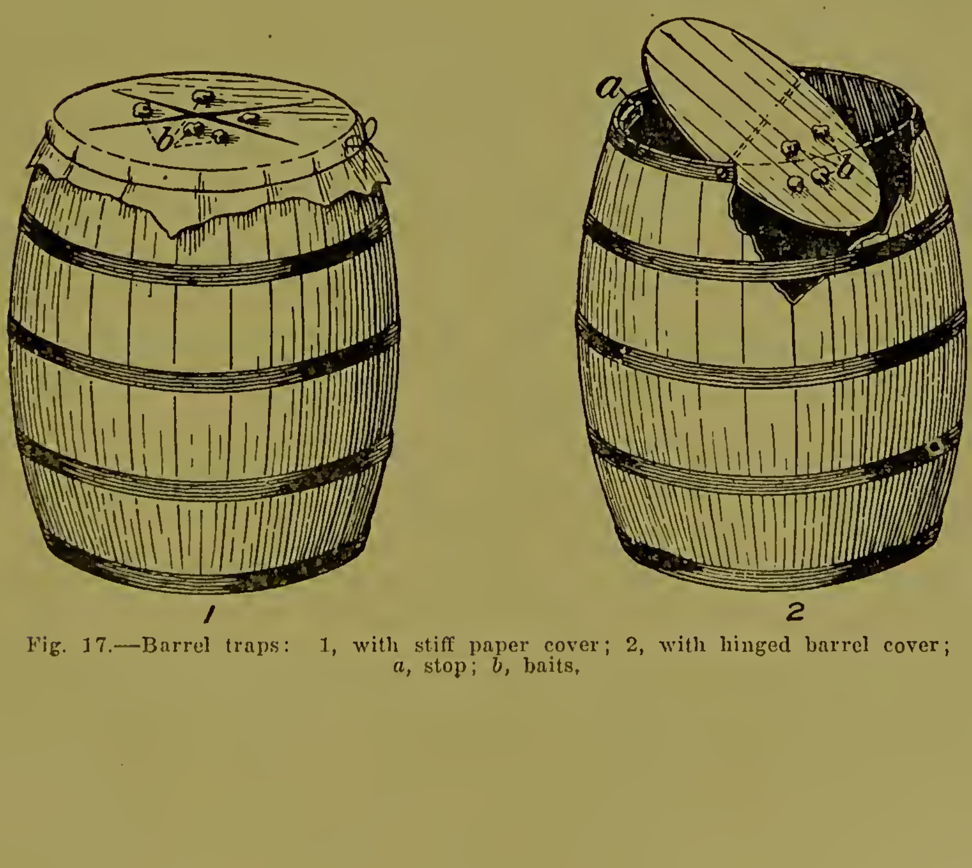

Fig. 17.—Barrel traps: 1, with stiff paper cover; 2, with hinged barrel cover; *a*, stop; *b*, baits.

a simple box with a light wood or metal cover in two sections, so hung on rods that they swing back to position after the weight of the rat is removed. They are intended to be sunk in runways, or around barnyards, haystacks and the like, so that the top is flush with the ground, and may be used with or without bait. They are effective placed along the fence outside a poultry yard, and protected with a shelter of brush or boards.

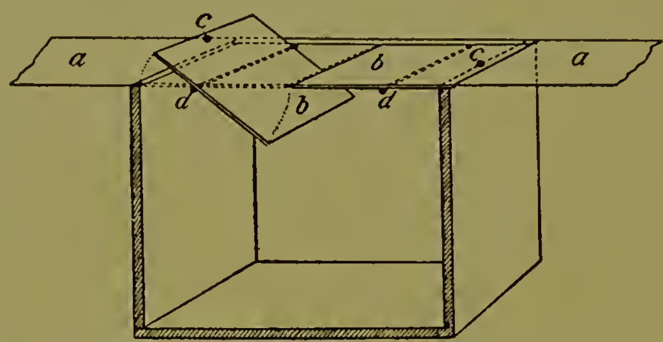

Fig. 18.—Pit trap. *aa*, Rat run; *bb*, cover; *cc*, position of weights; *dd*, rods on which cover turns.

Fence and Battue.—In the Orient, heaps of straw and litter are placed in the fields and left for several days until rats are attracted there in numbers. A portable bamboo fence is then set up around it, men and dogs enter, and the straw is then thrown over the fence. This method is useful at the removal of grain, hay or straw stacks, fine wire netting being substituted for the bamboo fence. Useless piles of brush may be set on fire and dogs used to catch the rats as they run out.

Poisons.—Poisons are the best and quickest way to get rid of rats—especially if they are present in numbers, but on account of the odor are not desirable around dwellings or food shops. They may be used most effectively around barns, corn cribs, sheds, stables and similar outbuildings. The various poisons will be named and described in detail.

Barium Carbonate.—This is very cheap and effective against both rats and mice, and has the advantage of having neither taste nor smell. It is corrosive to the mucous lining of the stomach, and in sufficient quantity is dangerous to larger animals, but in the dose fatal to rats and mice is devoid of action. It is a slow poison, and if there is an exit provided they usually go outside in search of water. It is best made into a dough with 4 parts of flour by weight or 8 parts of oatmeal by bulk, using sufficient water to mix.

It may also be spread on moistened toasted bread, fish or bread and butter. The prepared bait should then be scattered about the rat runs, a teaspoonful at a place. If a single application fails to kill or drive away all rats, it should be repeated with a change of bait.

STRYCHNINE.—This is a rapid, cheap and effective poison. It should be used in the form of the sulphate. The dry crystals may be inserted into bits of raw meat, Vienna sausage or toasted cheese, and these placed in rat runs or burrows, or oatmeal may be moistened with a strychnine syrup, made as follows: Dissolve one-half ounce of strychnine sulphate in a pint of boiling water, add a pint of thick sugar syrup and stir thoroughly. Smaller quantities may be prepared in the same proportion. Care must be taken to moisten all the oatmeal or grain with the syrup, and grain is more effective if left overnight to soak in it.

ARSENIC is a favorite rat-poison owing to its apparent cheapness, but owing to the smaller dose of strychnine required, the latter is really cheaper. Arsenic varies considerably in its effect on rats and a rat which has recovered from arsenic poisoning will rarely take the bait again. It may be used with any of the baits heretofore described under the first two paragraphs.

PHOSPHORUS is used almost as widely as arsenic, but owing to the danger of burning person or property is not recommended by the Biological Survey, hence its use will not be described here.

CAUTION!—Since the laying of poison on one's own lands is not usually regulated by law in the United States, their use should be even more guarded. Only in a few Western states, where poison is used for the destruction of other animals, is notice to one's neighbors necessary, but if poison is to be spread where it can affect any of a neighbor's stock, it is only common justice that he shall be duly informed. This applies particularly to arsenic and strychnine on meat, since valuable dogs may thus be unintentionally poisoned.

POISON IN POULTRY HOUSES.—If poison is to be put where poultry is kept, it is best placed inside of a small box, on the bottom and near the middle. Over this a considerably larger box is inverted. Both boxes have two or more openings sufficiently large to admit rats to the poison, but small enough to exclude poultry or other animals than rats or mice.

Domestic Animals.—DOGS.—Dogs are by far the best ratters among domestic animals. The small breeds, quick and active, as

the terriers, or small mongrels, if trained and intelligent, are wonderfully destructive to rats, and may be relied on to keep the premises reasonably free of rats.

Cats are over-rated as rat destroyers, and are usually too well-fed and lazy to relish the hard fights necessary to kill full-grown rats. They prefer mice and birds as more savory and easily caught, but do some service in killing young rats.

Ferrets like minks and weasels are inveterate foes of rats. They follow the rat into his burrow, and, unless muzzled, kill him and suck the blood, often lying by the kill for hours. They are best used to chase rats out of the burrows into the open where they can be killed by dogs. Dogs intended to work with ferrets must be quiet, and the dogs and ferrets must be accustomed to each other. Ferrets must be carefully guarded against escape, as if allowed to run wild, they would be very destructive.

Fumigation.—Carbon Disulphide (bisulphide of carbon) may be used to destroy rats in their burrows in fields, along river banks, levees and similar places, by saturating a piece of cotton in the liquid, forcing it into the burrow and then stopping the opening with wet earth to prevent the vapor from escaping. The rats and any other animals in the burrow are asphyxiated. As the vapor of carbon disulphide is very inflammable, care must be taken not to handle it near a flame.

Chlorine, carbon monoxide, sulphur dioxide, and *hydrocyanic acid* are also used for the destruction of rats in uninhabited buildings. It is necessary for their successful use that the building should be sufficiently tight to confine the gas until it has had time to penetrate to the haunts of the rats. Each has its special drawbacks. Chlorine is a powerful bleaching agent. Sulphur dioxide, if formed by the combustion of sulphur in open pans or kettles, is apt to cause fires unless very carefully handled, and is also a bleach. Carbon monoxide is odorless and if the building should be incautiously entered before the gas had escaped might cause death. Hydrocyanic acid destroys all animal life, but on account of its highly poisonous nature should be used only with the greatest caution. Full directions for the employment of sulphur and hydrocyanic acid will be found in the chapter on *Disinfection,* page 58. All of these poisons are alike open to the objection of doing their work too well. Too large a number of rats and other vermin are de-

stroyed at once, and the resultant stench is apt to make the place unapproachable.

Micro-organisms.—Several "rat-viruses" consisting of bacteria pathogenic to rats but not to other animals are on the market. The Biological Survey does not recommend them, on account of their uncertain action and expense.

Organized Action.—In this lies the key of the whole situation. If boys and young men can be interested in the sport of killing rats their numbers can be greatly reduced and the consequent danger of the propagation of plague, should it be introduced, will be minimized. Competition stimulated by appropriate prizes offered for efforts lasting over a considerable time will result in the training of the boys in methods of rat-hunting and in the breeding and training of dogs which will hunt and kill rats, whether with their masters or not. In the presence of plague it will be necessary to employ paid rat-catchers, operating under the special methods applicable to that situation.

The following summary is taken verbatim from the bulletin before mentioned:

SUMMARY OF RECOMMENDATIONS.

The following are important aids in limiting the numbers of rats and reducing the losses from their depredations:

1. Protection of our native hawks, owls, and smaller predatory mammals—the natural enemies of rats.

2. Greater cleanliness about stables, markets, grocery stores, warehouses, courts, alleys, and vacant lots in cities and villages, and like care on farms and suburban premises. This includes the storage of waste and garbage in tightly covered vessels and the prompt disposal of it each day.

3. Care in the construction of buildings and drains, so as not to provide entrance and retreats for rats, and the permanent closing of all rat holes in old houses and cellars.

4. The early thrashing and marketing of grains on farms, so that stacks and mows shall not furnish harborage and food for rats.

5. Removal of outlying straw stacks and piles of trash or lumber that harbor rats in the fields.

6. Rat-proofing of warehouses, markets, cribs, stables, and granaries for storage of provisions, seed grain, and feedstuffs.

7. Keeping effective rat dogs, especially on farms and in city warehouses.

8. The systematic destruction of rats, whenever and wherever possible, by (*a*) trapping, (*b*) poisoning, and (*c*) organized hunts.

9. The organization of rat clubs and other societies for systematic warfare against rats.

The Indiana legislature of 1913 passed a law which is now in effect delegating to health officers the power to compel rat extermination and to enter upon any premises for that purpose. The presence or threat of disease is not necessary for such action. This law also allows the proclamation of "Rat Extermination Days" either in municipalities or statewide. Public sentiment has not yet compelled or permitted an adequate use of this law, which is probably the first of the kind in the country.

CHAPTER XXIX.

ANTI-FLY CAMPAIGNS.

Sanitary Importance.—For ages the common house-fly was regarded as a pest but nothing more; a nuisance to be borne with each recurring warm season, but harmless aside from the annoyance of its buzzing and tickling, and its habit of committing suicide in food, or depositing its eggs or droppings therein.

But observations multiplied of septic diseases, anthrax, hospital gangrene, septicemia, and localized septic infections either known

Fig. 19.—The Poliomyelitis Fly. The stable fly or biting house fly (*Stomoxys calcitrans*): Adult, larva, puparium, and details. All enlarged. (L. O. Howard.)

(From Farmers' Bulletin No. 459, U. S. Department of Agriculture.)

to be conveyed by the mandibles of biting flies or the feet of sucking flies, or suspected to be.

Here the matter rested until the latter part of the summer of 1898, when the Vaughan-Shakespeare board began its investigations of the terrible typhoid epidemics which had raged in the concentration camps at Chickamauga and elsewhere, with a morbidity rate of approximately 20 per cent of all troops present. Before that time, typhoid fever had been considered to be always a water-borne disease, but the water was here found in most instances to be per-

fectly good, at least at its source. Early in their investigation they found that flies with feet covered with lime from the sinks and latrines were crawling over the food in the kitchens and mess-tents.

Diseases Carried.—By cultivating the filth from the feet and droppings of these flies, the typhoid organism was recovered in a number of instances. Later experiments, and the additional experience of the British in South Africa, have fully confirmed these conclusions, and have added a number of other diseases which are either known or are strongly suspected to be conveyed in the same manner. These include cholera, cholera nostras, dysentery, both amebic and bacillary, tuberculosis, the putrefactive diarrheas, and may reasonably be suspected to include smallpox, scarlet fever and measles. Later observations still, tend to show that the virus of anterior poliomyelitis may be conveyed in the same manner.

The Typhoid Fly.—Chapin is not inclined to ascribe the importance to the fly which is usually ascribed to it, but the writers had the opportunity to trace out a small epidemic three years ago in

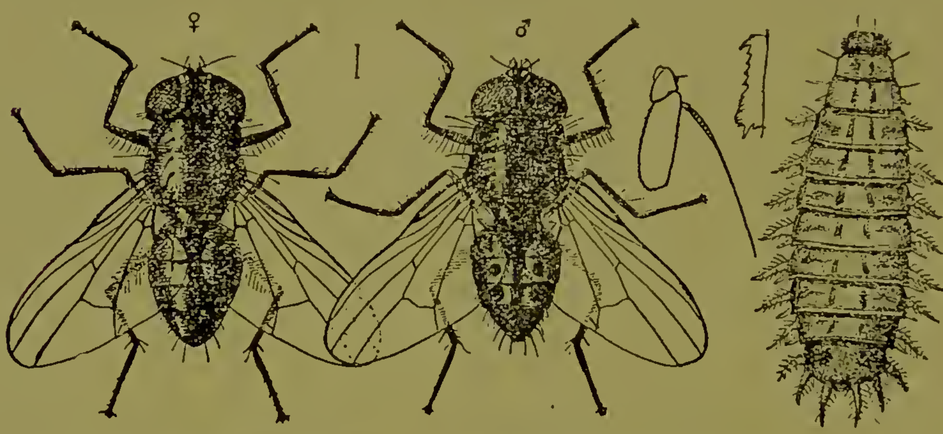

Fig. 20.—One of the Typhoid Flies. The little house fly (*Homalomyia brevis*): Female at left; male next, with enlarged antenna; larva at right. All enlarged. (L. O. Howard.)

(From Farmers' Bulletin No. 459, U. S. Department of Agriculture.)

which every other cause could be excluded definitely, and a probable source was found in a filthy open privy vault from which the infection could readily have been carried by flies to every person who was infected. This little epidemic of 20 cases had a mortality of 20 per cent, and all the cases were of severe type. It disappeared at once after the expiration of the usual incubation period of two weeks, on the cleaning and closure of the vault.

Military sanitarians ascribe great importance to the fly as a trans-

mitter of disease, and it is a fact that, since the introduction of incinerators and flyproof latrines, typhoid has almost entirely disappeared as a post-maneuver disease. This is not due to antityphoid inoculation, since comparatively few of the organized militia troops have submitted to protective vaccination. It is not in the least intended that the importance of the fly as a carrier of typhoid and similar diseases shall be magnified at the expense of food and water infection, carriers and contact infection, or other proved method of transmitting disease, but only to point out that in small places where open privies abound, the fly *must* be taken into account as a probable factor.

Classification.—A discussion of the systematic nomenclature and morphology of the flies would be out of place here, beyond the statement that the flies are all members of the order *Diptera,* the Two-winged Insects, and comprise many species, genera, and several families of biting or suctorial insects, all of which are to be guarded against in the same way.

With this brief résumé of the fly as a disease carrier, the importance of the subject to the health officer becomes at once apparent.

Fortunately for the human race, the fly has a number of natural enemies, in the shape of birds, other insects, and vegetable parasites —particularly fungi, which tend to keep down their numbers, which would otherwise render life impossible or at least unbearable.

Life History.—Flies breed with great rapidity. Each adult female fly deposits several hundred eggs during her life, and in favorably warm weather, the entire cycle from the egg, through the pupa or maggot, to the imago or adult, takes, in the common house-fly but 8 days. Unfavorable conditions may lengthen this period to 10 or 11 days, but since the increase is geometrical in ratio, it is easy to see the immense numbers to which the progeny of a single female may reach in the course of a season, without natural or artificial checks. The genesis of the swarms that infest our streets and houses is thus manifest.

Prevention of Breeding.—Since flies breed only in filth, the first thing to do is to render it impossible for the fly to reach any of the accumulations unavoidable around habitations.

This is done:

1. By destroying filth wherever found.
2. By rendering it distasteful or poisonous to flies or their larvæ by the use of lime, kerosene, oil of pennyroyal or cresol.

3. By excluding light from the receptacle, or by screens which the flies cannot pass.

The most difficult part of an anti-fly campaign is teaching the people to dispose of their garbage properly. The subject of garbage disposal, being treated in a special chapter, will not be discussed here, but it is to be noted that no amount of screening, trapping or poisoning, will make up for careless disposal of filth and waste. All such materials *must* be promptly destroyed or buried.

Lime, applied in powder, is neither very distasteful nor damaging to the adult fly, and if air-slaked, not at all. If a really good suspension of milk of lime (calcium hydrate) is mixed with the garbage or refuse, the eggs and pupæ or maggots of the fly are at once destroyed, but it must be made to come in contact with the eggs or maggots to do any good. Kerosene oil is more effective, but more expensive. Where crude oil or low-grade distillates are procurable, the expense is much lessened. Oil of pennyroyal, in the proportion of 1 ounce to 1 quart of kerosene, is very distasteful to the adult fly, as well as fatal to the young, and a small quantity sprinkled around the garbage can is sufficient to keep away all flies. The greatest drawback is the expense. Cresol is not expensive, and may be used freely in 2 per cent emulsion.

Privy vaults, manure bins and similar places must be made and kept perfectly dark. Flies are pre-eminently light-seeking insects, and greatly abhor dark places. Screens may be made to answer the same purpose, but to be effective must be made automatically self-closing, otherwise they are sure to be left open and to fail of their object.

Fly Poisons.—Poisons for flies are of different classes. Most of the proprietary ones are arsenical. Formaldehyd in dilute solution has been often recommended, but is *only a pleasant intoxicant* and *not a poison.* A sweetened 1:1000 solution of corrosive sublimate is cheap and good.

Any of these poisons must be put where children cannot get them. They, like the small traps mentioned later, are most useful when set in an otherwise darkened room, by a partly lighted and partly opened window, in a light current of air, and must be placed in shallow dishes. Poisons are not recommended for indoor use.

Fly Traps.—The most successful way of destroying adult flies is by the use of traps, of which there are several good makes on the

market, all employing the very old principle of an outer cone or cylinder of wire gauze, with an inner cone of the same material having an opening at the point. The apparatus is supported on short legs a short distance above the floor or table, or has a false bottom with a marginal opening which permits the flies to enter.

Fig. 21.—Wire gauze fly traps.

It is baited with bread and milk, molasses and vinegar, stale egg or spoiled banana. The flies seek the bait and on attempting to fly, rise into the upper cone through the opening in the lower one and are unable to find their way back.

In the smaller traps, the flies are killed by scalding or holding for a minute over a flame, but in the larger ones are allowed to die of crowding, the dead ones being shaken out through a door in the bottom and the live ones flying to the top. The small traps are intended for indoor use or for attachment to garbage cans, and the larger are set outside on the street. The large traps have been

known to catch 100,000 in a couple of days. For the benefit of anyone wishing to see how effectively the trap is working, it may be stated that 2,500 house-flies weigh one ounce.

Fly Paper.—For killing the last remnants of swarms in the house, sticky fly-papers are invaluable, as they catch both germ and fly. The following formula is recommended for its manufacture: Rosin, 2 parts, castor oil, 1 part (by weight); boil in a kettle until of the consistency of thick molasses and spread on any kind of paper. The remainder may be put into a fruit jar until wanted. In boiling, it must be remembered that the mixture is inflammable. The careful housewife also uses the "swatter" to advantage.

The use of screens is necessary to keep out flies blown or coming from other places, but cannot be depended on to exclude them completely, unless doors are closed with a screened vestibule, having an outer and an inner screened door, closing automatically. This arrangement is to be recommended for hospitals, restaurants and other places where it is imperative to keep out all flies.

Since flies are known to fly at least half a mile with favoring winds, it is evident that anti-fly work to be effective must be enforced over as large areas as possible. The good results, if obtained, are reached by a ceaseless campaign of publicity in newspapers and by placards, and by the employment of a sufficiently large and intelligent sanitary police force. Aside from the securing of an adequate and healthful water supply, no other measure will so improve the public health and decrease the sickness and death-rates, especially among children.

CHAPTER XXX.

THE MOSQUITO.

Sanitary Importance.—The sanitary importance of the mosquito was first brought home to the American profession by the excellent work of the Reed Yellow Fever Commission in 1900-1901, which demonstrated the connection between the *Stegomyia* mosquito and that disease. That discovery has led to extensive anti-mosquito campaigns in almost every civilized country, not only for the suppression of yellow fever, but for the control of malaria, dengue and filariasis, all of which are mosquito-borne diseases. The most brilliant and successful of these campaigns have been those in Cuba, beginning in 1900, and that in the Canal Zone, which was begun in 1905 and continues to the present.

Classification.—Mosquitoes compose the family *Culicidæ* of the order of Diptera, the Two-winged Insects. They are subdivided into two sub-families—the *Anophelines* and the *Culicines.* The principal genus from a sanitary standpoint, of the first sub-family, is the genus *Anopheles,* of which a number of species are known to be malaria carriers; while the Culicines, which comprise among other genera, *Culex,* whose species distribute dengue and filariasis, and *Stegomyia,* the yellow fever mosquito. The generic and specific differences among these insects are too small to be recognized by the unskilled observer, and will be omitted here. There is one very obvious mark, however, which distinguishes the Anophelines from the Culicines, the position when at rest. The Culicines when at rest keep the body nearly parallel to the surface on which they stand, while the Anophelines stand out at an angle of 45 degrees, and have the appearance of standing on their heads. The note of the Anopheles is also lower-pitched than that of Culex, and it is more apt to fly silently. Only female mosquitoes bite.

Life History.—The eggs of mosquitoes are tiny cylinders less than a millimeter in length, and one-sixth to one-fourth of that in width, which are deposited in clear still water almost anywhere. Anopheles will also deposit the eggs in running water among the

weeds that are submerged along the banks. The eggs vary in number from 20 to 75 or more, and in Culex are deposited in a single boat-shaped mass, while the other genera mentioned divide them

Fig. 22.—Anopheles mosquito; adult female; enlarged. (After Howard.)

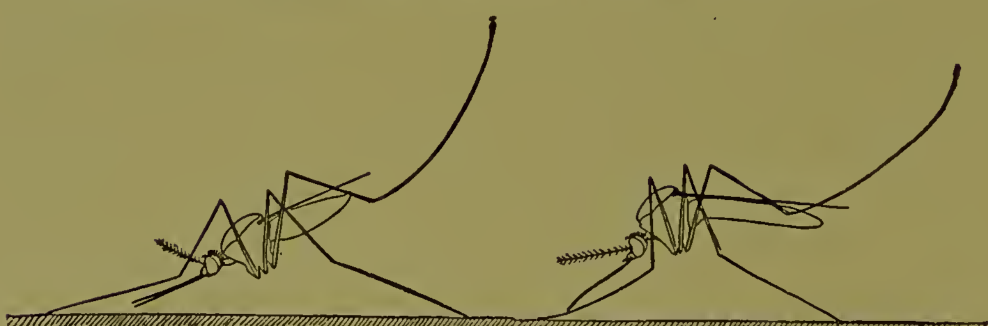

Fig. 23.—Resting position of Anopheles and Culex mosquitoes. (After Howard.)

by twos and threes. They may remain floating or may be submerged without much influenee on future development. Drying for considerable periods can also be sustained with only partial

damage, and some species are also able to withstand a good deal of cold, while on the other hand the typical yellow fever mosquito, *S. fasciata*, has its development much interfered with or stopped entirely by even moderate cold. The development of mosquitoes is most rapid when the temperature is 75° or over, at which point the complete development from the egg to the perfect adult is passed through in from 11 to 18 days.

There are two stages which intervene between the egg and the adult insect, the larva or "wiggletail" and the pupa or chrysālis. The larval stage is familiar to everyone who has observed small collections of stagnant water and watched the actively swimming and twisting embryos. The pupal stage is passed attached to some convenient object, and after the lapse of from 2 to 5 or 6 days, the mosquito emerges, leaving the cast skin behind.

Natural Enemies.—In anti-mosquito campaigns, the larvæ are the point of attack, although most of the measures which destroy the larvæ will destroy pupæ. The adult mosquitoes are too mobile to be readily attacked except by fumigation, a process which is altogether too expensive except for the immediate neighborhood of infected houses. Fortunately we have the assistance of many natural enemies in fighting against mosquitoes. The larvæ and pupæ are eaten by fishes of many of the smaller kinds and by tadpoles, and the adults are caught by many birds, dragon-flies, toads, frogs and lizards. Some of these we are enabled to enlist as regulars in the war, as for instance certain fishes are placed in ponds, drainage ditches and so on, with a view to killing off the larvæ, while the presence of swifts and swallows around houses is often encouraged for the same reason.

Drainage.—The great remedy against mosquitoes is proper drainage and clearing up by every necessary means all collections of useless and stagnant water. Next to this is proper protection of needed water collections as tanks, cisterns and reservoirs by appropriate means.

It is not necessary to have a large amount of water for mosquitoes to breed. An old tin can, a gutter spout, the fork of a tree or anything which will hold enough water not to evaporate entirely before rain falls again, will breed mosquitoes. Therefore, in beginning work against mosquitoes, the starting place must be the clearing of all localities near dwellings of their accumulated tin cans, broken bottles, empty jugs and the like, and the clearing out and making

secure of all house gutters. Then all pools on the ground must be filled up or drained, after which one is ready to begin on the larger problems involved. In draining areas of any size, it will be necessary to have the services of an engineer to lay off levels and lay out the ditches, but small places can generally be disposed of by merely clearing and deepening the natural runway by which the overflow gets away. These ditches must be clear-cut and sharp, and once made must be kept clear of vegetation. If the pond is too large to drain, it may be cleaned around the edges and have minnows or other fish placed in it or be covered with a film of crude petroleum, which will quickly kill both larvæ and pupæ. This treatment is also good for cesspools and privy vaults, but a better is to abolish them. Roof-tanks, cisterns and water used for domestic purposes must be screened with a fine-mesh screen.

Anti-mosquito Work.—Anti-mosquito work can only be done well if done systematically, by trained men, acting under ample authority. There must be a responsible head who directs all the work. He must be provided with a map of the territory to be gone over, and must route his inspectors so that they cover it absolutely thoroughly. The work of draining, cleaning up and so on cannot well be done by the municipality in many cases on account of the cost, but orders can be issued designating the measures to be taken, as outlined in the foregoing paragraphs, and after the expiration of the time, the inspectors will make their investigation, point out defects to householders and issue specific orders under penalty of prosecution. A second inspection is then necessary to see that the orders have been carried out, and subsequent inspections at intervals to see that the original conditions have not recurred.

Such a campaign as this is usually only made in threatened or actual epidemics of yellow fever, but might well be undertaken for severe epidemics of malaria. Short of this, some good can be done by educating the people to the fact that mosquitoes are not only a nuisance but disease carriers, and that any mosquitoes found in their houses are usually bred within 100 yards of the place. Short talks to school children are good means of getting ideas on mosquito and fly extermination into the homes of the people, while newspaper publicity can often be had free and always for a consideration. Campaigns of education may grow into the more serious

and formal measures recommended in the last paragraph and in any event are not to be despised.

Very extensive anti-mosquito work has been done by many American cities, notably New York, the New Jersey cities, and New Orleans. Much of this has been done against the voracious and annoying, but otherwise harmless Salt-water Mosquito, *Culex sollicitans*, with the result that the other mosquitoes have also been diminished. The Southern cities in general have been watchful against the Stegomyia, and yellow fever is now but little dreaded in consequence.

Fumigation.—Should the destruction of adult mosquitoes become necessary it may be accomplished by the use of sulphur fumigation of all parts of the house simultaneously, using 2½ lbs. per 1,000 cubic feet, or 1 lb. of pyrethrum for the same area; in the latter case, the fumes of the burning pyrethrum only stupefy the insects and after an hour's exposure they must be swept up and burned.

The following additional suggestions are from Bulletin No. 444. Department of Agriculture, by Dr. L. O. Howard:

MIMMS CULICIDE.

This mixture is made of equal parts by weight of carbolic acid crystals and gum camphor. The acid crystals are melted over a gentle heat and poured slowly over the gum, resulting in the absorption of the camphor and a final clear, somewhat volatile liquid with an agreeable odor. This liquid is permanent, and may be kept for some time in tight jars. Volatilize 3 ounces of this mixture over a lamp of some kind for every 1,000 cubic feet of space. A simple apparatus for doing this may be made from a section of stovepipe cut so as to have three legs and an outlet for draft, an alcohol lamp beneath and a flat-bottom basin on top. The substance is inflammable, but the vapor is not explosive. The vapor is not dangerous to human life except when very dense, but it produces a headache if too freely breathed. Rooms to be fumigated should be made as nearly air-tight as possible.

OTHER FUMIGANTS.

According to Dr. John B. Smith, powdered jimson weed (*Datura stramonium*) can be burned to advantage in houses. He recommends 8 ounces to fumigate 1,000 cubic feet of space. He states that it should be made up by the druggist into an amount with niter or saltpeter 1 part to 3 of Datura, so as to burn more freely. He states that the fumes are not poisonous to human beings, are not injurious to fabrics or to metals, and can be used with entire safety. He suggests that it be burned in a tin pan or on a shovel.

The burning of dried orange peel has been recommended as a deterrent against mosquitoes by a Japanese physician.

APPARATUS FOR CATCHING ADULT MOSQUITOES.

An interesting homemade apparatus in common use in many parts of the United States is very convenient and effective. It consists of a tin cup or a tin can cover nailed to the end of a long stick in such a way that a spoonful or so of kerosene can be placed in the cup, which may then, by means of the stick, be pressed up to the ceiling so as to inclose one mosquito after another. When covered over in this way the captured mosquito will attempt to fly and be caught in the kerosene. By this method perhaps the majority of the mosquitoes in a given bedroom—certainly all of those resting on the ceiling—can be caught before one goes to bed.

Mr. H. Maxwell-Lefroy, of India, makes a trap consisting of a wooden box lined with dark-green baize and having a hinged door. The trap is 12 inches long, 12 inches broad, and 9 inches deep. A small hole, covered by a revolving piece of wood or metal, was prepared in the top of the box. Owing to the habit of mosquitoes to seek a cool, shady place in which to rest, such as a dark corner of the room or a book shelf, or something of that sort, they will enter the trap, which is put in the part of the room most frequented by mosquitoes, all other dark places being rendered uninhabitable so far as possible. They are driven out of book shelves with a duster or with tobacco smoke, and go into the desirable sleeping place for the day. The door is then closed and fastened, and into the small hole at the top of the box a teaspoonful or less of benzine is introduced. This kills all of the mosquitoes inside, and the box is then thoroughly aired and replaced. In this way Mr. Lefroy is very successful in catching mosquitoes. At one time he averaged 83 a day.

CHAPTER XXXI.

PREVENTION OF SOIL POLLUTION.

THE SANITARY PRIVY.[1]

Soil Pollution.—Soil pollution is the surest evidence of a state of savagery or barbarism. Its prevention is the price which civilization, which gathers men into cities and towns, must pay for health in its citizens and for its own very existence. No sensible farmer would pasture his stock or rear poultry year after year on the same soil without expecting to pay for his carelessness with heavy loss. The explanation is simple—that the excreta of all animals contain within them parasites, animal or bacterial, which accumulate in the soil until the health of the stock or poultry can no longer be maintained on account of continuing infection and reinfection.

Savage and barbarous men avoid this for their flocks and herds and themselves by frequent migrations, which, while they perhaps have their root in superstitious notions, serve to give a relative immunity from the effects of soil pollution. More than 4,000 years ago Moses prescribed a method for disposing of human excreta that is still followed in military practice, with slight elaboration. Military surgeons with marching commands so well understand the dangers of soil pollution that even after a camp of a single night, the sinks are carefully closed and their positions marked so that they are not likely to be reopened in case of a return to the same site. Such being the case, how can we expect to have a satisfactory degree of public health in a town where pictures like that of Figure 24 continually obtrude themselves on the eye and nostrils?

Disease Transmission.—The diseases most commonly transmitted through pollution of the soil by human excreta are TYPHOID FEVER, HOOKWORM, DYSENTERY, both bacillary and amebic,

[1] For a complete discussion of this topic, with working plans complete for the construction of the sanitary privy, see Public Health Bulletin No. 37, Public Health and Marine Hospital Service, "The Sanitary Privy," by Ch. Wardell Stiles, Ph.D., Professor of Zoölogy, Hygienic Laboratory, from which the text of this chapter is largely abstracted and the illustrations borrowed.

ASIATIC CHOLERA, tape-worms, SUMMER DIARRHEA, eel-worm infection, and very possibly the exanthemata.

The popular idea of a privy, as indicated by its name, is a place where the demands of nature may be satisfied with due regard to privacy. Stiles very properly defines it, from a sanitary standpoint, as "An outhouse designed, *primarily,* to prevent soil

Fig. 24.—An insanitary privy, found too frequently on our farms. Notice how the animals are spreading soil pollution. (After Stiles.)

pollution and hence to prevent the spread of disease through dissemination of disease germs contained in the excreta; *secondarily,* to insure privacy and safeguard modesty to persons responding to the daily calls of nature."

According to this definition, the essential part of the privy is a receptacle which will safeguard the contents against dissemination by any and all agents, as for instance, rain, insects (flies, etc.),

chickens, swine, dogs, etc. Secondly, it should provide a retiring room for the people responding to nature's calls. While this second part is not absolutely essential, it is desirable, since if the privy is a comfortable place for that purpose, other places are not so apt to be sought, and the fecal accumulations are all in one

Fig. 25.—The average style of privy found in the South. It is known as a surface privy, open in back. Notice how the soil pollution is being spread, and how flies can carry the filth to the house and thus infect the food. (After Stiles.)

place where they can be properly disposed of, instead of being scattered all over the farm, in the woods, the fields and the barn.

The points, then, to be considered in the construction of a sanitary privy are:

1. The provision of a proper receptacle for the protection of

the excreta from all agencies which may spread the contained germs.

2. To make the outhouse so comfortable that it will be sought in preference to any other place.

3. To make it in such a way that the poorest citizen can afford it.

How NOT to Build a Privy.—Figure 24 shows a privy which not only outrages the senses, but is a menace to health. Figure 25 is not so great an offender against the sense of sight and better answers the demands of decency, but is not a whit better in the matter of sanitary needs. The night-soil simply overflows upon the ground, to be carried by rain, wind, flies and animals in all directions. Such privies, even if cleaned daily, are a public danger, but the man who is so benighted as to build an abomination of this kind ordinarily never cleans it. Any one who has been at all familiar with this type of outhouse knows the swarms of flies that gather about it in warm weather, and the poultry and swine feed upon its filth. Such a privy on a dairy farm should condemn it absolutely till a proper closet is substituted, on account of the danger from typhoid fever and other filth diseases.

How to Build a Privy.—This subject is of so great importance in town and rural sanitation that Dr. Stiles' description and specifications which represent the best solution of the problem yet devised, are reprinted complete, both for single privies for dwellings and larger ones for hotels and schools. The general use of such privies in towns not supplied with sewerage systems and in the country would practically wipe out typhoid fever, hookworm, dysentery and other diseases having a like mode of transmission. The conscientious sanitarian cannot do otherwise than urge and force their use to the best of his ability.

How to build a privy.—Figures 26 and 27 show a privy designed to comply with the revised definition given above. The following are the essential features: There is (A) a closed portion (box) under the seat for the reception (in a receptacle) and safeguarding of the excreta; (B) a room for the occupant; and (C) there is proper ventilation.

A. The receptacle consists practically of a box, with a top represented by the *seat*, with a *floor* which is a continuation of the floor of the room, with a *front* extending from the seat to the floor, with a *hinged back* which should close tightly, and with two *sides* continuous with the sides of the room and provided with wire screened ventilators, the upper margin of which is just under the level of the seat. The seat should have one or more holes according to the size of the privy desired, and each hole should have a *hinged lid* which lifts up toward the back of the room; there should be a piece of wood

nailed across the back, on the inside of the room, so as to prevent the lids from being lifted sufficiently to fall backward and so as to make them fall forward of their own accord as soon as the person rises. In this box there should be one or more water-tight tubs, half barrels, pails, or galvanized cans, corresponding to the number of holes in the seat. This receptacle should be high enough to reach nearly to the seat, or, better still, so as to fit snugly

Fig. 26.—A sanitary privy, designed to prevent soil pollution. Galvanized pails may be used instead of tubs. The door should be kept closed. The ventilators should be wire-screened to keep out flies. The seats should be provided with hinged lids. It is best to use deeper tubs than are pictured here. (After Stiles.)

against the seat, in order to protect the floor against soiling, and sufficiently deep to prevent splashing the person on the seat; it should be held in place by cleats nailed to the floor in such a way that the tub will always be properly centered. The back should be kept closed, as shown in figure 27.

B. The room should be water-tight and should be provided in front with a good, tightly fitting *door*. The darker this room can be made the fewer flies will enter. The *roof* may have a single slant, as shown in figure 26, or a double slant, as shown in figure 27, but while the double slant is somewhat

more sightly, the single slant is less expensive on first cost. The room should be provided with two or three wire-screened ventilators, as near the roof as possible.

C. The ventilators are very important additions to the privy, as they permit a free circulation of air and thus not only reduce the odor but make the outhouse cooler. These ventilators should be copper wire screened in order to keep out flies and other insects. There should be at least 4 (better 5) ven-

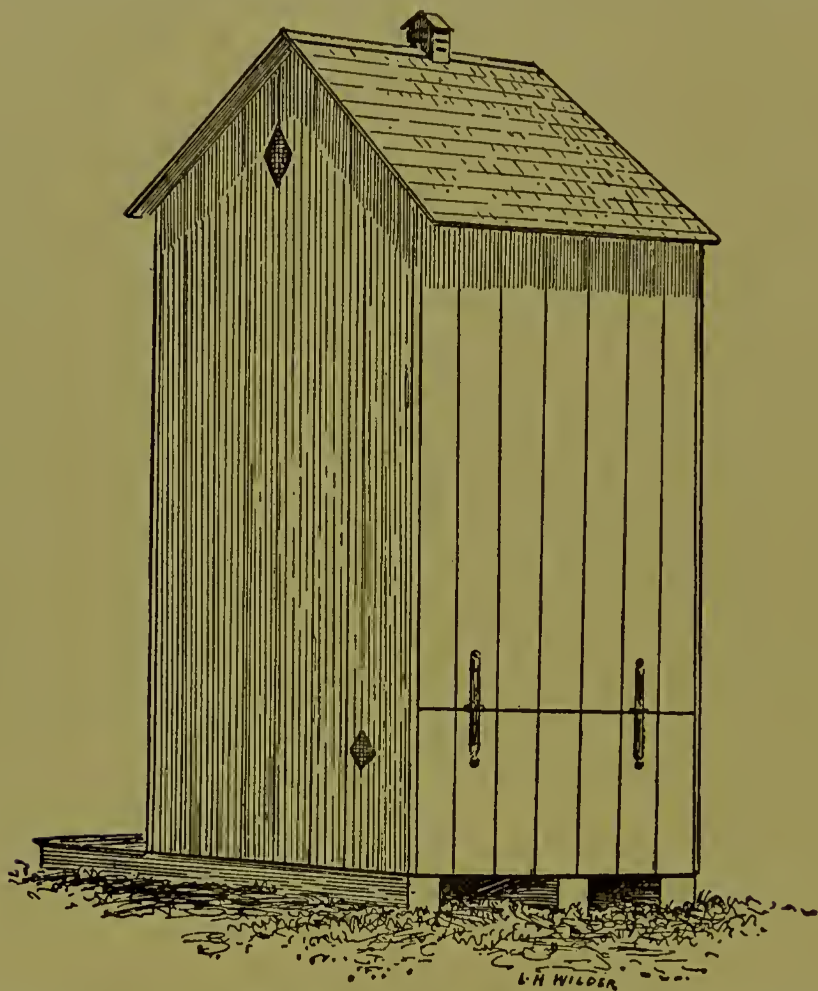

Fig. 27.—A sanitary privy, designed to prevent the spread of disease. If a privy of this type were built on every farm and in every yard in villages, and if this privy were used by all persons, typhoid fever, hookworm disease, and various other maladies would almost or entirely disappear. (After Stiles.)

tilators, arranged as follows: One each side of the box; one each side of the room near the roof; and a fifth ventilator, over the door, in front, is advisable.

Latticework, flowers, and vines.—At best, the privy is not an attractive addition to the yard. It is possible, however, to reduce its unattractiveness by surrounding it with a latticework on which are trained vines or flowers. This plan, which adds but little to the expense, renders the building much less unsightly and much more private.

DISINFECTANT.—It is only in comparatively recent years that the privy has been thought worthy of scientific study, and not unnaturally there is some difference of opinion at present as to the best plan to follow in regard to disinfectants.

(*a*) *Top soil.*—Some persons prefer to keep a box or a barrel of top soil, sand, or ashes in the room and to recommend that each time the privy is used

Fig. 28.—A single-seated sanitary privy. Front view. (After Stiles.)

the excreta be covered with a shovelful of the dirt. While this has the advantage of simplicity, it has the disadvantage of favoring carelessness, as people so commonly (in fact, as a rule) fail to cover the excreta; further, in order to have the best results, it is necessary to cover the discharges very completely; finally, at best, our knowledge as to how long certain germs and spores will live under these conditions is very unsatisfactory.

(*b*) *Lime.*—Some persons prefer to have a box of lime in the room and

to cover the excreta with this material. Against this system there is the objection that the lime is not used with sufficient frequency or liberality to keep insects away, as is shown by the fact that flies carry the lime to the house and deposit it on the food.

(*c*) *Water and oil.*—A very cheap and simple method is to pour into the tub about 2 or 3 inches of water; this plan gives the excreta a chance to ferment and liquefy so that the disease germs may be more easily destroyed. If

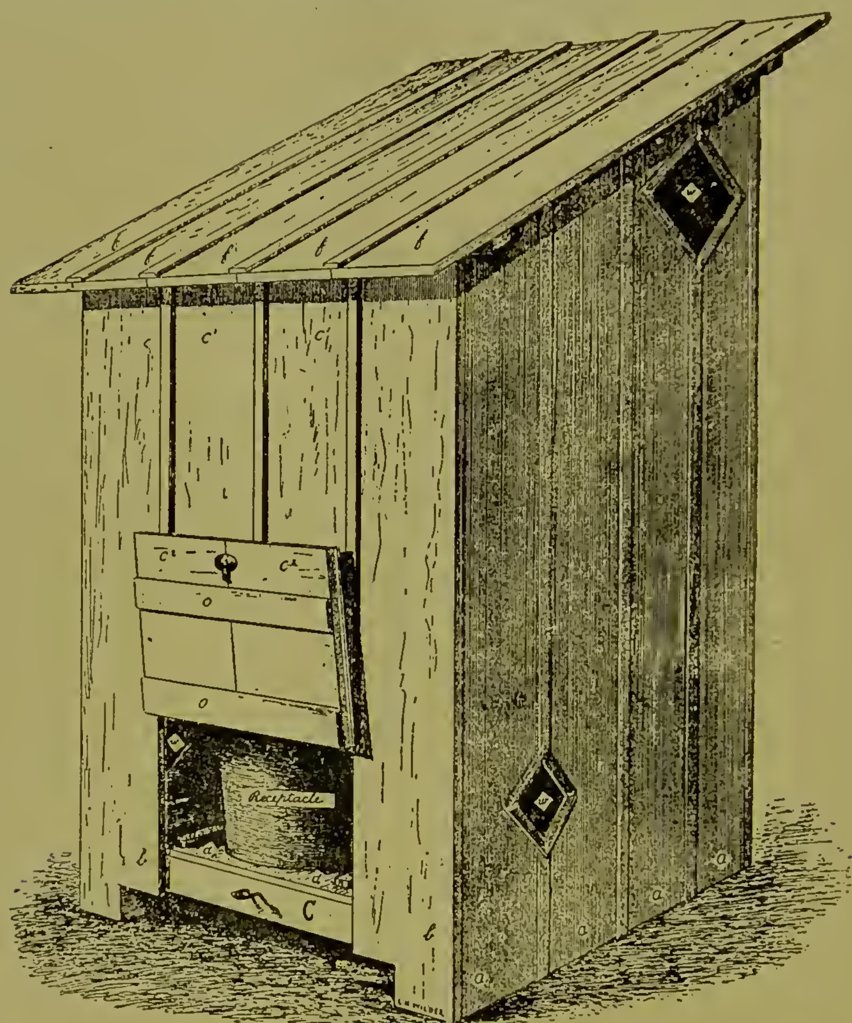

Fig. 29.—Rear and side view of privy shown in Fig. 28. (After Stiles.)

this plan is followed a cup of oil (kerosene will answer) should be poured on the water in order to repel insects.

(*d*) *Cresol.*—Some persons favor the use of a 5 per cent crude carbolic acid in the tub, but probably the compound solution of cresol (U. S. P.) will be found equally or more satisfactory if used in a strength of 1 part of this solution to 10 parts of water.

If a disinfectant is used the family should be warned to keep the reserve supply in a place that is not accessible to the children, otherwise accidents may result.

Cleaning the receptacle.—The frequency of cleaning the receptacle depends upon (*a*) the size of the tub, (*b*) the number of persons using the privy, and (*c*) the weather. In general, it is best to clean it about once a week in winter and twice a week in summer.

An excellent plan is to have a double set of pails or tubs for each privy. Suppose the outhouse is to be cleaned every Saturday: Then pail No. 1 is taken out (say January 1), covered, and set aside until the following Saturday; pail No. 2 is placed in the box for use; on January 8 pail No. 1 is emptied and put back in the box for use while pail No. 2 is taken out, covered, and set aside for a week (namely, until January 15); and so on throughout the year. The object of this plan is to give an extra long time for the germs to be killed by fermentation or by the action of the disinfectant before the pail is emptied.

Each time that the receptacle is emptied, it is best to sprinkle into it a layer of top soil about a quarter to half an inch deep before putting it back into the box.

Disposal of the excreta.—For the present, until certain very thorough investigations are made in regard to the length of time that the eggs of parasites and the spores of certain other germs may live under various plans (*a*) to (*d*) (see pages 293-294), **it is undoubtedly best to burn or boil all excreta**; where this is not feasible, it is best to bury all human discharges at least 300 feet away and down hill from any water supply (as the well, spring, etc.).

Many farmers insist upon using the fresh night soil as fertilizer. In warm climates this is attended with considerable danger, and if it is so utilized, it should never be used upon any field upon which vegetables are grown which are eaten uncooked; further, it should be promptly plowed under.

In our present lack of knowledge as to the length of time that various germs (as spores of the ameba which produce dysentery, various eggs, etc.) *may live, the use of fresh, unboiled night soil as a fertilizer is false economy which may result in loss of human life. This is especially true in warm climates.*

Directions for Building a Sanitary Privy.

In order to put the construction of a sanitary privy for the home within the carpentering abilities of boys, a practical carpenter has been requested to construct models to conform to the general ideas expressed in this article, and to furnish estimates of the amount of lumber, hardware, and wire screening required. The carpenter was requested to hold constantly in mind two points, namely, (1) economy and (2) simplicity of construction. It is believed that any 14-year-old schoolboy of average intelligence and mechanical ingenuity can, by following these plans, build a sanitary privy for his home at an expense for building materials, exclusive of receptacle, of $5 to $10, according to locality. It is further believed that the plans submitted cover the essential points to be considered. They can be elaborated to suit the individual taste of persons who prefer a more elegant and more expensive structure. For instance, the roof can have a double (fig. 27) instead of a single slant, and can be shingled; the sides, front, and back can be clapboarded or

they can be shingled. Instead of one seat (figs. 28, 29) or six seats (figs. 30, 31), there may be two, three, four, or five seats, etc., according to necessity.

A Single-seated Privy for the Home.—Nearly all privies for the home have seats for two persons (fig. 26), but a single privy can be made more economically.

Framework.—The lumber required for the framework of the outhouse shown in figure 28 is as follows:

A. Two pieces of lumber (scantling) 4 feet long and 6 inches square at ends.

B. One piece of lumber (scantling) 3 feet 10 inches long; 4 inches square at ends.

C. Two pieces of lumber (scantling) 3 feet 4 inches long; 4 inches square at ends.

D. Two pieces of lumber (scantling) 7 feet 9 inches long; 2 by 4 inches at ends.

E. Two pieces of lumber (scantling) 6 feet 7 inches long; 2 by 4 inches at ends.

F. Two pieces of lumber (scantling) 6 feet 3 inches long; 2 by 4 inches at ends.

G. Two pieces of lumber (scantling) 5 feet long; 2 by 4 inches at ends.

H. One piece of lumber (scantling) 3 feet 10 inches long; 2 by 4 inches at ends.

I. Two pieces of lumber (scantling) 3 feet 4 inches long; 2 by 4 inches at ends.

J. Two pieces of lumber (scantling) 3 inches long; 2 by 4 inches at ends.

K. Two pieces of lumber (scantling) 4 feet 7 inches long; 6 inches wide by 1 inch thick. The ends of K should be trimmed after being nailed in place.

L. Two pieces of lumber (scantling) 4 feet long, 6 inches wide, and 1 inch thick.

First lay down the sills marked A and join them with the joist marked B; then nail in position the two joists marked C, with their ends 3 inches from the outer edge of A; raise the corner posts (D and F), spiking them at bottom to A and C, and joining them with L, I_2, G, and K; raise door posts E, fastening them at J, and then spike I_1 in position; H is fastened to K.

Sides.—Each side requires four boards (a) 12 inches wide by 1 inch thick and 8 feet 6 inches long; these are nailed to K, L, and A. The corner boards must be notched at G, allowing them to pass to bottom of roof; next draw a slant from front to back at G–G, on the outside of the boards, and saw the four side boards to correspond with this slant.

Back.—The back requires two boards (b) 12 inches wide by 1 inch thick and 6 feet 11 inches long, and two boards (c) 12 inches wide by 1 inch thick and 6 feet 5 inches long. The two longest boards (b) are nailed next to the sides; the shorter boards (c) are sawed in two so that one piece (c^1) measures 4 feet 6 inches, the other (c^2) 1 foot 11 inches; the longer portion (c^1) is nailed in position above the seat; the shorter portion (c^2) is later utilized in making the back door.

Floor.—The floor requires four boards (d) which (when cut to fit) measure 1 inch thick, 12 inches wide, and 3 feet 10 inches long.

Front.—The front boards may next be nailed on. The front requires (aside from the door) two boards (e) which (when cut to fit) measure 1 inch thick, 9 inches wide, and 8 feet 5 inches long; these are nailed next to the sides.

Roof.—The roof may now be finished. This requires five boards (f) measuring (when cut to fit) 1 inch thick, 12 inches wide, and 6 feet long. They are so placed that they extend 8 inches beyond the front. The joints (cracks) are to be broken (covered) by laths one-half inch thick, 3 inches broad, and 6 feet long.

Box.—The front of the box requires two boards, 1 inch thick and 3 feet 10 inches long. One of these (g) may measure 12 inches wide, the other (h) 5 inches wide. These are nailed in place, so that the back of the boards is 18 inches from the inside of the backboards. The seat of the box requires two boards, 1 inch thick, 3 feet 10 inches long; one of these (i) may measure 12 inches wide, the other (j) 7 inches wide. One must be jogged (cut out) to fit around the back corner posts (F). An oblong hole, 10 inches long and 7½ inches wide, is cut in the seat. The edge should be smoothly rounded or beveled. An extra (removable) seat for children may be made by cutting a board 1 inch thick, 15 inches wide, and 20 inches long; in this seat a hole is cut, measuring 7 inches long by 6 inches wide; the front margin of this hole should be about 3 inches from the front edge of the board; to prevent warping, a cross cleat is nailed on top near or at each end of the board.

A cover (k) to the seat should measure 1 inch thick by 15 inches wide by 20 inches long; it is cleated on top near the ends, to prevent warping; it is hinged in back to a strip 1 inch thick, 3 inches wide, and 20 inches long, which is fastened to the seat. Cleats (m) may also be nailed on the seat at the sides of the cover. On the inside of the backboard, 12 inches above the seat, there should be nailed a block (l), 2 inches thick, 6 inches long, extending forward 3½ inches; this is intended to prevent the cover from falling backward and to make it to fall down over the hole when the occupant rises.

On the floor of the box (underneath the seat) two or three cleats (n) are nailed in such a position that they will always center the tub; the position of these cleats depends upon the size of the tub.

Back door.—In making the back of the privy the two center boards (c) were sawed at the height of the bottom of the seat. The small portions (c^2) sawed off (23 inches long) are cleated (o) together so as to form a back door which is hinged above; a bolt or a button is arranged to keep the door closed.

Front door.—The front door is made by cleating (p) together three boards (q) 1 inch thick, 10 inches wide, and (when finished) 6 feet 7 inches long; it is best to use three cross cleats (p) (1 inch thick, 6 inches wide, 30 inches long), which are placed on the inside. The door is hung with two hinges (6-inch "strap" hinges will do), which are placed on the right as one faces the privy, so that the door opens from the left. The door should close with a coil spring (cost about 10 cents) or with a rope and weight, and may fasten on the inside with a catch or a cord. Under the door a crosspiece (r) 1 inch thick, 4 inches wide, 30 inches long (when finished) may be nailed to the joist. Stops (s) may be placed inside the door as shown in figure 5. These should be 1 inch thick, 3 inches wide, and 6 feet 6 inches long, and should be

jogged (cut out) (t) to fit the cross cleats (p) on the door. Close over the top of the door place a strip (v) 1 inch thick, 2 inches wide, 30 inches long, nailed to I. A corresponding piece (v) is placed higher up directly under the roof, nailed to G. A strap or door pull is fastened to the outside of the door.

Ventilators.—There should be five ventilators (w). One is placed at each side of the box, directly under the seat; it measures 6 to 8 inches square. Another (12 inches square) is placed near the top on each side of the privy. A fifth (30 inches long, 8½ inches wide) is placed over the door, between G and I_1. The ventilators are made of 15-mesh copper wire, which is first tacked in place and then protected at the edge with the same kind of lath that is used on the cracks and joints.

Lath.—Outside cracks (joints), are covered with lath one-half inch thick by 3 inches wide.

Receptacle.—For a receptacle, saw a water-tight barrel to fit snugly under the seat; or purchase a can or tub, as deep (17 inches) as the distance from the under surface of the seat to the floor. If it is not possible to obtain a tub, barrel, or can of the desired size, the receptacle used should be elevated from the floor by blocks or boards so that it fits snugly under the seat. A galvanized can measuring 16 inches deep and 16 inches in diameter can be purchased for about $1, or even less. An empty candy bucket can be purchased for about 10 cents.

Order for material.—The carpenter has made out the following order for lumber (pine, No. 1 grade) and hardware to be used in building a privy such as is shown in figure 28:

1 piece scantling, 6 by 6 inches by 8 feet long, 24 square feet.
1 piece scantling, 4 by 4 inches by 12 feet long, 16 square feet.
5 pieces scantling, 2 by 4 inches by 16 feet long, 54 square feet.
3 pieces board, 1 by 6 inches by 16 feet long, 24 square feet.
2 pieces board, 1 by 9 inches by 9 feet long, 14 square feet.
3 pieces board, 1 by 10 inches by 7 feet long, 18 square feet.
15 pieces board, 1 by 12 inches by 12 feet long, 180 square feet.
12 pieces board, ½ by 3 inches by 16 feet long, 48 square feet.
2 pounds of 20-penny spikes.
6 pounds of 10-penny nails.
2 pounds of 6-penny nails.
7 feet screen, 15-mesh, copper, 12 inches wide.
4 hinges, 6-inch "strap," for front and back doors.
2 hinges, 6-inch "T," or 3-inch "butts," for cover.
1 coil spring for front door.

According to the carpenter's estimate, these materials will cost from $5 to $10, according to locality.

There is some variation in the size of lumber, as the pieces are not absolutely uniform. The sizes given in the lumber order represent the standard sizes which should be ordered, but the purchaser need not expect to find that the pieces delivered correspond with mathematical exactness to the sizes called for. On this account the pieces must be measured and cut to measure as they are put together.

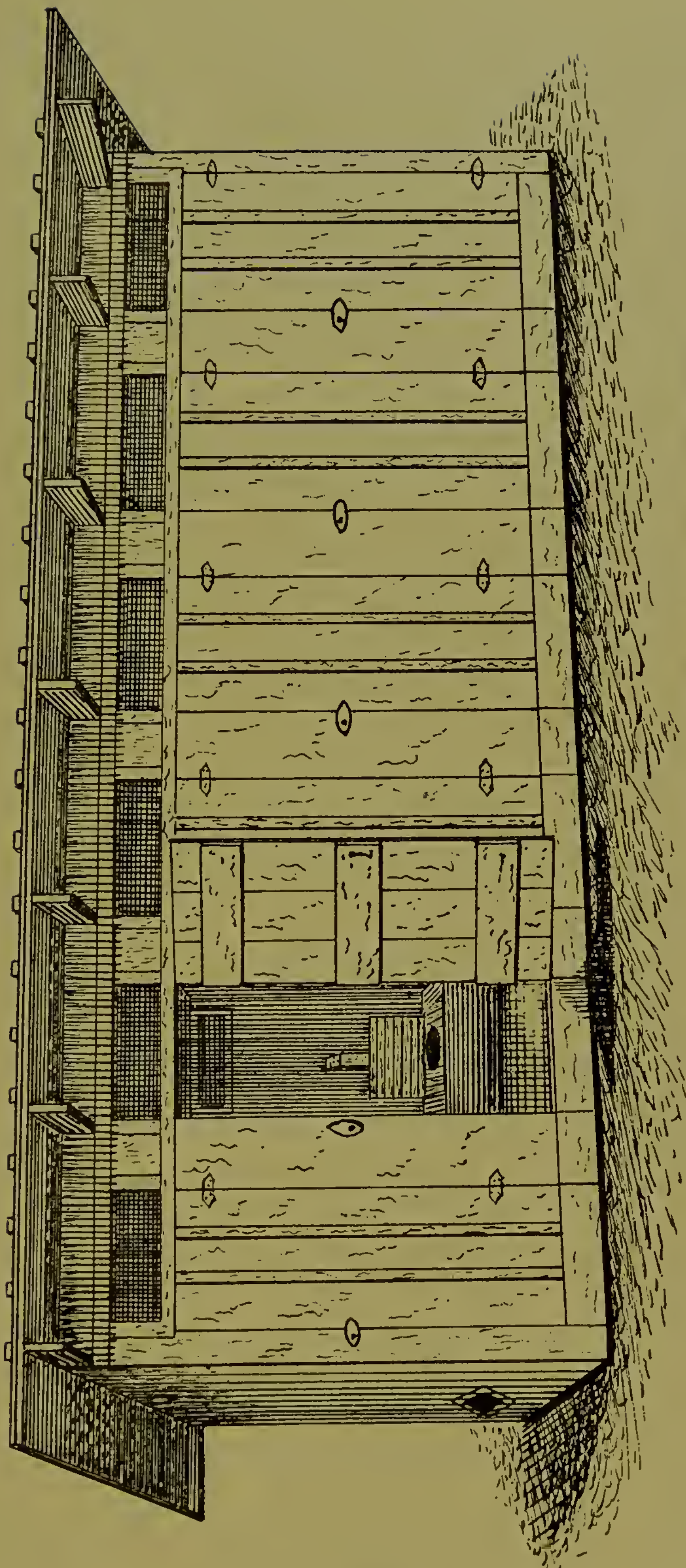

Fig. 30.—A six-seated sanitary privy, for hotels and schools. Front view. (After Stiles.)

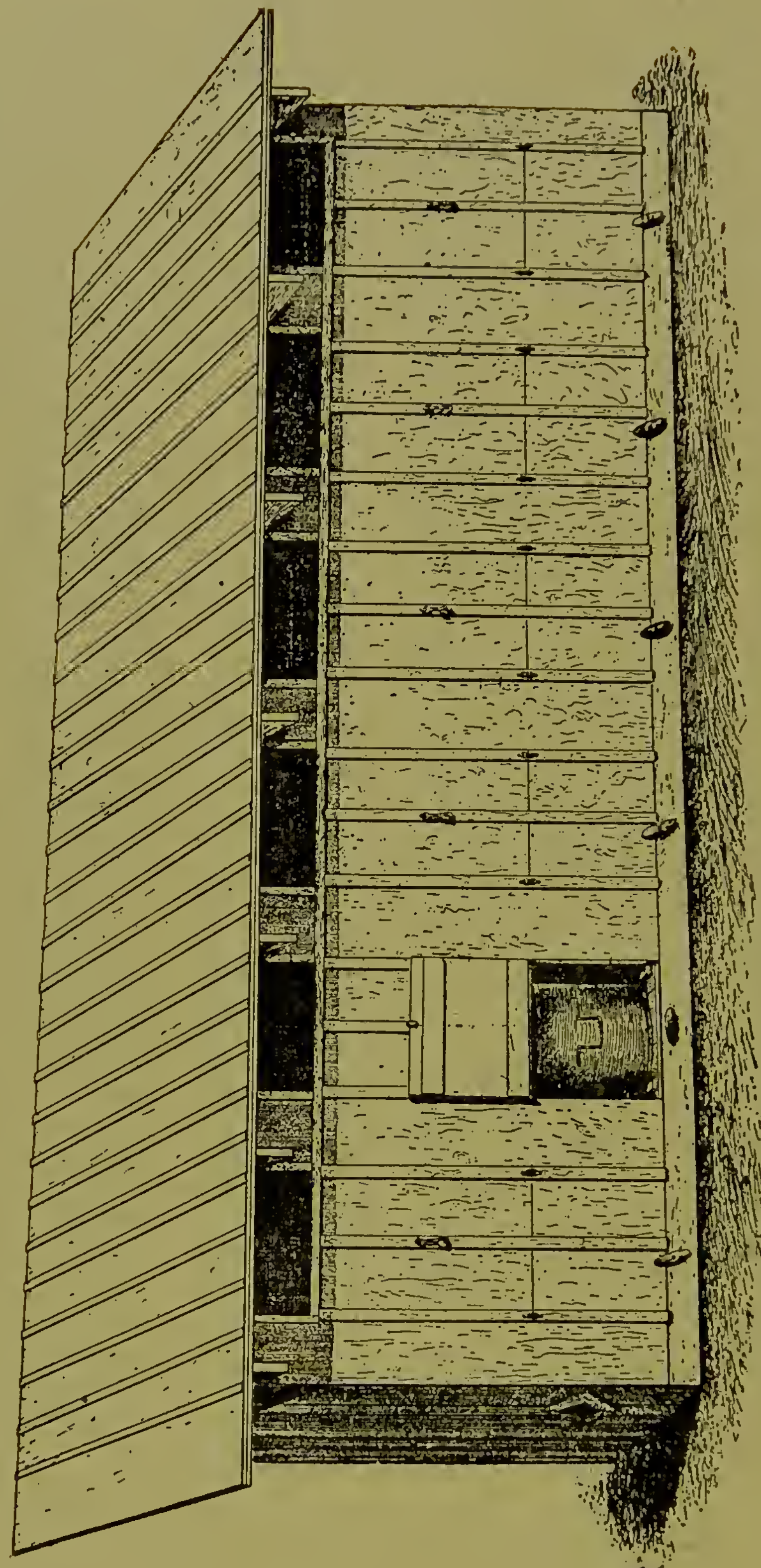

Fig. 31.—Rear view of privy shown in Fig. 30. (After Stiles.)

Estimate of Material for School Privy.

The following estimate of building materials has been made, by a carpenter, for the construction of a six-seated school privy such as is shown in figure 30. The estimated cost of these materials is $25 to $50, according to locality; this does not include the pails, which ought not to cost over $1 a piece:

3 pieces scantling, 6 by 6 inches by 20 feet, 180 square feet.
1 piece scantling, 6 by 6 inches by 8 feet, 24 square feet.
Scantling, 2 by 4 inches, 165 square feet.
Boards, 1 by 12 inches, 600 square feet.
Boards, 1 by 10 inches, 185 square feet.
Boards, 1 by 8 inches, 100 square feet.
Boards, 1 by 6 inches, 80 square feet.
Boards, ½ by 3 inches, 100 square feet.
Flooring, 80 square feet.
40 feet 15-mesh copper wire screen, 12 inches wide.
12 pairs of hinges, 6-inch "strap."
6 pairs of hinges, 6-inch "T."
3 pounds of 20-penny spikes.
15 pounds of 10-penny nails.
8 pounds of 6-penny nails.
6 coil springs for front doors.
6 knobs or latches.

A Compulsory Sanitary Privy Law.—Privy License.

A compulsory sanitary privy law or ordinance should exist and be strictly enforced in all localities in which connection with a sewer system is not enforced.

Since, from a sanitary point of view, the privy is a public structure, in that it influences public health, it seems wisest to have city and town ordinances which provide for a licensing of all privies, the license being fixed at a sum which will enable the city or town to provide the receptacle (tub, pail, etc.), the disinfectant, and the service for cleaning. The expense involved will vary according to local conditions, such as cost of labor and density of population. If the "chain gang" can be utilized for cleaning, the expense for labor is reduced.

The importance of taking the responsibility for the care of the privy out of the hands of the family is evident when one considers that one careless family in ten or in a hundred might be a menace to all. Quite generally the removal of garbage and of ashes is recognized as a function of the city or town in all better organized communities, and the idea is constantly spreading that this service should extend to a removal of the night soil also.

In correspondence with certain cotton mills, estimates for privy cleaning (once a week) vary from about 20 to 25 cents per privy per month. A privy tax of $3.50 to $5 per privy per year ought to give satisfactory service, including receptacle, but the exact amount of the tax must be determined by experience in each locality.

It is probably the exception that an economical public privy-cleaning service can be carried out in the open country, on account of the distances between the houses. To meet the difficulties involved, several suggestions may be considered, according to conditions: A county privy tax can be levied, the county can furnish the pail and the disinfectant, and (1) one member of each family or of several neighboring families hired to clean the privy regularly; or (2) the landlord can be held responsible for the cleaning of all privies of his tenants, receiving from the county a certain sum for the service; or (3) "trusties" from prisons might possibly be utilized in some districts not too sparsely settled; or (4) a portion of the county privy tax might perhaps be apportioned by school districts and be distributed as prizes among the school boys who keep their family privy in best conditions; or (5) each head of family might be held responsible for any soil pollution that may occur on his premises and be fined therefor.

Undoubtedly the problem of the privy cleaning in the open country is much more difficult than in cities, villages, and towns, and in the last instance involves a general education of the rising generation of school children, more particularly of the girls (the future housekeepers), in respect to the dangers of soil pollution.

CHAPTER XXXII.

SEWAGE DISPOSAL.

Water-closets.—Where water under pressure is available, water-closets are, if properly installed, the most eonvenient way of disposing of human exereta. This sewage is then condueted through drains of vitrified tile of proper size, away from the house. In towns and cities having a munieipal sewerage system within reaeh, every householder should be required to eonneet his premises with it. The subjeet of munieipal disposal of sewage is beyond the seope of this handbook, further than to say that there are a number of ways in whieh sewage may be made harmless, and in some of whieh it is made useful. Every munieipality installing a sewer system has its own particular problems to meet, owing to the varying topography and geology of the country, the density of the population served, the probable growth of the town, the amount of sewage to be handled, the presence or absence of paeking-house and other manufaeturing wastes, and so on. One method is here mentioned to be eondemned—the discharge of raw sewage either into streams or tidewater, sinee it invariably beeomes a souree of danger to eommunities to which the water earries it.

Sewer Construction.—Any munieipality about to build a sewer system should consult with the State Board of Health or State Sanitary Engineer as to the problems involved, and for the aetual construetion should employ the very best sanitary engineer they ean afford. A few hundred dollars more in the way of a fee will frequently save thousands in eonstruetion, or will make the differenee between an easily operated, satisfactory system and one the reverse in every way. If the detailed plans are submitted to the State Sanitary Engineer before aeceptance, it will prevent any criticism afterward in ease there is trouble.

Where there is no munieipal system of sewers, the householder is compelled to dispose of this waste himself. This may be done in a number of ways, of whieh two very satisfaetory ones will be here notieed:

1. *By leaching cesspools.* This method is mentioned only to be condemned. In it the cesspool is not built tight, but the contents are expected to leach into the ground or to find their way into rock fissures. It is a highly effective way of contaminating water supplies even at a considerable distance.

2. *By tight cesspools.* These are underground tanks, built like a cistern, and cemented in the same way. They require to have the contents pumped or bailed out at intervals, varying with the duty performed by them. They are much more expensive to install than the next form, but are sometimes the only method available. The expense of emptying is also a disadvantage. If emptied, the contents must be put on a field and plowed under, the field then being planted to some crop which will not be contaminated.

3. *The Septic Tank.* This consists of two underground communicating compartments so arranged that the sewage which has

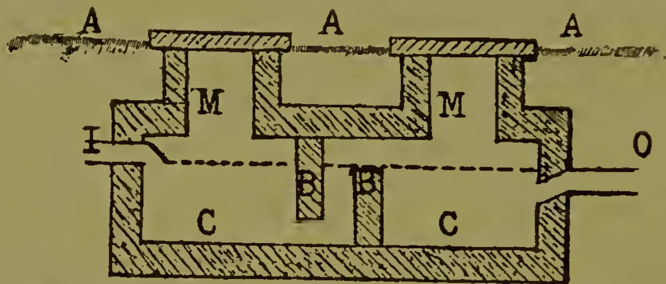

Fig. 32.—Cement Septic Tank. *AAA*, ground level; *BB*, baffles; *CC*, septic chambers, *MM*, manholes; *I*, inlet; *O*, outlet;. Dotted line indicates surface of fluid. (Adapted from Steiner.)

undergone fermentation and partial destruction of its organic contents by the anærobic organisms contained in it, flows out through porous tiles just deep enough not to be reached by frost, and the remainder of the material is oxidized and destroyed by the nitrifying bacteria of the soil. In localities where the soil is frozen to considerable depths, this method will hardly be found satisfactory, since the frost line will probably be deeper than the nitrifying bacteria are able to penetrate. In climates which will admit of it, the tile drain should run only 10 or 12 inches below the surface, with a slope of about 1 inch to 20 feet.

The arrangement of the chambers is shown in the cut, Figure 32. The dimensions inside are 8 feet in length by 4 in width and 3 in depth. The manholes are for the purpose of cleaning out the sludge, which is necessary only about once in two years. The material should be concrete of good quality, 4 inches thick.

The inlet is by an elbow so placed that the mouth rests at the water level, or a trifle below, forming a trap. The two baffles shown in the cross section prevent a too rapid flow into the second chamber. The tank must be kept dark, and the influx and efflux of the sewage so arranged that the liquid is disturbed as little as possible, since the anærobic organisms work better in quiet.

The inlet pipe is of vitrified pipe, cemented at the joints, laid with as little fall as will insure freedom from clogging.

The outlet tile is also laid with little fall, as above stated, in order that the seepage may be constant along its whole length and not wet the surface of the ground at any one place. In fairly porous soil a drain of 50 feet in length will be sufficient. The effluent can also be discharged into a field drain without danger, in the country. The cost of a septic tank of the capacity named is about $250.00 to $300.00, and the materials are to be had anywhere. Metal septic tanks are also to be had, which answer the same purpose.

Either of the methods 2 and 3 will give good results if properly built and cared for. They must not be allowed to run over on the surface of the ground nor to leak into the soil, and if so handled, present probably the best ways of caring for sewage in towns not provided with municipal sewage.

Incineration.—Incinerators are now built which are very satisfactory so far as sanitary results are concerned, but most of them are slightly disagreeable on account of odors during the process of burning up the excrement. They are made in all sizes, from one seat to a dozen or more, and are a very good solution of the problem of public closets in small towns.

CHAPTER XXXIII.

DISPOSAL OF GARBAGE.

Garbage Nuisances.—Almost the most annoying problems which the health officer has to deal with in small municipalities are those connected with the disposal of garbage. People will throw slops, dishwater, kitchen refuse, tin cans or what not into the alleys, their own or their neighbors back yards. Small animals are allowed to remain unburied or unburned, and the health officer is called in to settle the difficulty when the neighbors complain of the nuisance.

Garbage Disposal.—There are three practical ways to dispose of garbage: to bury it, to burn it, and to have it hauled away. In small places where the building lots are large, burial is a very good way. The pits are dug just big enough to hold a pail of garbage, and are at once filled in with 3 or 4 inches of earth over the top, and a new site is taken for each successive pail.

If coal or wood is used for fuel, the liquids are drained from the garbage, and the solid residue placed in the ash-pan when the fire is first lighted. In half an hour it will be sufficiently dry to burn, and may be placed on the fire. There then remains nothing but ashes to be disposed of. Tin cans should always be burned out to destroy the organic matter which draws flies, and to melt them apart, in order that they may not collect water where mosquitoes may breed when thrown on the dump.

Dumping.—In places where gas is used for cooking, it is probable that the building lots will be too small to bury wastes and coal or wood stoves will not be available to burn them. During cold weather heating stoves or furnaces may be utilized as incinerators, but during hot weather it will be necessary to have all wastes hauled to a distance from town and dumped. This is properly a function of the municipality, but will ordinarily be paid for privately for a long time before the municipality can be induced to take it up. These dumps will become a nuisance if located near roads or dwellings, and it is best to utilize the waste materials for filling up an

unsightly ravine or sinkhole, if possible. If this cannot be done, a plan should be devised for burning up organic matter at intervals, with the assistance of crude oil or other combustible, and utilizing a time of dry weather for it. Otherwise flies may become a great nuisance near the dump. The practice of feeding raw garbage to hogs is dangerous and should not be allowed.

There are two great cardinal principles in the handling of garbage at all stages; the solid and liquid portions must be kept separate, and flies must be kept out. The best way of doing the first is by the use of two covered cans, one having a strainer, and of the second, is to see that the covers are always in place. Metallic cans should be used but are not always practical on account of the expense. Large lard-cans make good garbage cans, and cost next to nothing.

All ordinances of this kind are difficult of enforcement because the laity cannot be made to see their importance. The only remedy for this is a long continued campaign of education, with prosecution in flagrant cases.

Manure.—The proper care of stable manure in order that it may not become a breeding place for flies is best attained by requiring it to be kept in a dark place and moved at least once a week. Cement bins are best for this purpose, as they retain the liquid constituents in the manure, instead of allowing them to drain off and become a nuisance.

CHAPTER XXXIV.

SANITARY FOOD INSPECTION.

Laws.—Laws having to do with the preparation and sale of food products are of two kinds—*Pure Food Laws* and *Sanitary Food Laws*. Laws of the first sort have to do with the prevention of adulterations, and the maintenance of certain standards of quality as determined by chemical analysis, while statutes of the second kind aim at the production of foods and their preservation in approved ways.

Pure food laws will not be considered further than to say that all of the states have statutes concerning the standards of food and drugs which may be sold within their borders, while the United States act covers articles sold in inter-state commerce. But the standards set up by these different laws vary so much that it would be unprofitable, outside of a monograph on the subject, to attempt to take them up in detail. One thing most of them have in common, and in common also with sanitary food laws—they brand as adulterated foods containing dirt of any description. The health official who desires to take up any part of the pure food and drug work will obtain copies of the law, directions and labels for taking samples, containers for special kinds of samples and all needed information on applying to his own State Board of Health.

Pure food laws, as has just been stated, do not necessarily concern themselves with the surroundings in which a food article is made. Sanitary food laws do. It is evidently much more important that a dairyman, for instance, should produce his milk under the best conditions, so that it has a low bacterial count, than that he should add a little clean water to it, especially if it be a very rich milk to begin with. Hence, the sanitary inspection of food producing establishments of all kinds is a matter to be attended to with scrupulous care.

General Principles.—There are certain general principles to be followed out in all inspections of this nature. The inspector on entering the place asks for the proprietor or employee in charge,

states the nature of his business, and if asked for, shows his authority to make the inspection. Having identified himself, any attempt to prevent the inspection places the person so doing in the position of resisting an officer, and the inspector will call assistance from constables, the sheriffs and deputies, or the police. In some states it will also be necessary to procure a search-warrant owing to defectively drawn laws. Notice of any kind in advance of the inspection is manifestly against public policy and is never given; the notice given in showing the authority to make the investigation is sufficient.

In most states blank forms are provided for this work, but if none is provided, the inspector may follow this schedule.

INSPECTOR'S NUMBER.........

1. Name of Owner. 2. City or Town. 3. County. 4. Street and Number. 5. Date. 6. Nature of business as bakery, confectionery, drugstore, slaughterhouse, etc. 6. Is floor clean? Under this head it is important to look for evidences of expectoration, especially behind counters, and for dust and dirt everywhere. 7. Are walls and ceilings clean? Smoked ceilings are not unsanitary in themselves, but are evidence of a slackness in matters of cleanliness which is something of an index to other conditions. Fly-specked walls and ceilings always show carelessness in the matter of admitting flies to the place, and call for orders looking to their exclusion. 8. Are shelves and counters clean? This is not only a matter of æsthetics but a matter of good or bad sanitation. 9. Are back rooms clean? Many establishments which look all right to the customer have very dirty hidden places which it is the duty of the inspector to find. 10. Is back yard tidy? A back yard that is badly cared for is a breeding place for flies. It must be kept thoroughly clean. 11. Is cellar clean and tidy? Like other out-of-sight places, the cellar is prone to be neglected, and is one of the places to be gone over with the greatest care, especially if food is prepared or stored in it, and unless it is thoroughly well-lighted and ventilated either preparation or storage should be forbidden. 12. Are toilets provided? This expression means not only the water or other closet, but proper means for cleansing the hands whenever they become soiled. Where located? The closet must not be located in such a way that it communicates directly with any part of the establishment where food is prepared or stored. The lava-

tory should be as near the work as possible. 13. Are light and ventilation of the establishment satisfactory? 14. Are screens provided? 15. Are flies abundant? 16. Are spittoons in use? They should be provided and should be cared for by being emptied daily, washed out with an antiseptic solution, and a few ounces of the solution left in. 17. Are employees neat and clean? 18. Apparently healthy? Those who are tubercular should not assist in the care or sale of food products, for their own sakes as well as that of the general public. 19. Is any of the rooms used as a sleeping room? 20. Is garbage removed daily? 21. Is the water supply abundant and good? 22. Is hot water available whenever needed?

Special questions relating to different kinds of establishments follow:

Groceries and Meat Markets.—Is refrigerator clean? Musty? Slimy? In inspecting refrigerators, bread-boxes, etc., the nose is a much better detective than the eye. If a refrigerator *smells* clean it is almost certainly clean, but if it only *looks* clean, it may be very dirty indeed from a sanitary standpoint. Is meat slimy? Covered with mould? Is meat-block clean and sweet? Is meat of good quality? (This subject will be taken up in detail in a later paragraph of this chapter.) Is meat displayed outside shop? This should never be permitted, as it is thereby exposed to dust and flies. Are sausage, etc., made on the premises? Are lard and tallow rendered on premises? Are scraps from block used in sausage? Rendered for food? Provided only clean scraps are used and are properly cared for until utilized, there is no objection to their utilization in sausage, lard or other food products. If they are so used, the condition of the stored scraps must be ascertained. Is milk sold? If sold, is it properly cared for in a separate ice-box or compartment? Are goods protected from dogs? Are dried fruits clean? Is confectionery protected from flies and dust? Are newspapers used for wrapping? This is a very bad practice.

Hotels, Restaurants, Ice Cream Parlors, Lunch Carts.—The remarks in the last paragraph concerning care of ice-boxes and of milk apply with equal force to this class of business. A few special questions are appended:

Are shelves, tables and sinks clean? Are dishes and tableware properly washed? Rinsed in hot water? Is food from table re-

turned to kitchen and served again? Is food left uncovered on tables or shelves? This is a very important matter as flies and dust are great carriers of disease.

Drug Stores.—Is soda fountain used? Are fountain syrups made or bought? Are the glasses washed? In hot water? In running water? Are goods clean? Fresh? Is prescription counter clean? Are tinctures, extracts, etc., made? Bought? Where made? Are patents properly labeled? This clause applies especially to the content of alcohol, morphine, cocaine, chloral, chloroform, acetanilid, etc., required by the National Food and Drug Act. Is candy protected from dust and flies?

Bakeries and Confectioneries.—Is bake-shop clean? Are goods properly handled?

Slaughterhouses.—Is killing floor kept clean? Where is rendering done? Where are hides stored? Is offal fed on premises? Is it cooked before feeding? If uncooked, it affords an excellent means for inoculating the hogs with tapeworm, trichinosis and tuberculosis, as well as some other diseases of less importance. Is water provided for cleaning floor and walls? Is cooling-room provided? Cold storage room? Are meats inspected by (a) United States government inspectors? (b) Local inspectors? Where are condemned carcasses stored? How are they finally disposed of? The only fit disposition for condemned carcasses and parts of carcasses is in soap-grease and tankage.

Inspection of Foodstuffs.—This is a very important part of the sanitarian's duties. He can assure himself without calling in the aid of the food chemist, that food is clean, undecomposed so far as the senses can tell, not frozen improperly, and if frozen in cold storage and exposed for sale that it is not sold for fresh goods, not over-ripe (fruit and vegetables) and that it is properly cared for so as not to be exposed to too high a temperature, or to flies and dust.

Condemnation of Food Products.—The machinery for this varies with locality. In some places food inspectors have police powers and can summarily seize the material for condemnation and arrest the man in charge. In others he must file a complaint and take the condemned goods before a justice of the peace or police judge who issues the warrant for the arrest of the man and the order for the destruction of the spoiled articles, and in still a third group of places the inspector can seize the goods without warrant, but

must secure a warrant for the arrest of the owner. In many cases a judicious threat or a very little moral suasion will induce the man to destroy the unfit goods, especially if several charges can be brought against him and he thereby secures immunity from all but one.

Condemned liquids are usually disposed of by emptying into a sewer or upon the ground; animal foods by soaking in coal-oil before sending to the dump or crematory, and condemned vegetables and fruits by dumping.

It should be remembered that all decomposing food substances are apt to cause poisoning, the nature and severity of the poisoning being determined by the bacterial flora present and by the stage of decomposition. Most cases of food poisoning are evidenced by vomiting, diarrhea, chilliness followed by elevation of temperature, cramps in the abdomen and often in the limbs and back, and prostration. Death may result, and when many persons have partaken of the affected food, the cases may take on the characteristics of an epidemic. Meat foods, especially sausage, head cheese, and similar made dishes are particularly liable to cause such troubles; while milk, ice cream and cheese are even more so. Vegetable foods are more rarely at fault, but present a considerable number of cases in the aggregate. Two or three micro-organisms have been isolated from sausage which had caused symptoms of poisoning, which were capable of reproducing the conditions. Vaughan's pioneer work on the tyrotoxicon poisoning of milk and cheese is well known. Some recent researches on epidemic jaundice (Weil's disease) seem to show that it is an infection by the *Bacillus proteus* propagated in food. More specific information is catalogued under the various heads in the following portions of this chapter.

Meat Foods.—The Indiana State Board of Health defines meat as follows: "Meat, flesh, is any clean, sound, dressed and properly prepared edible part of animals in good health at the time of slaughter, and if it bears a name descriptive of its kind, composition or origin, it corresponds thereto. The term 'animals' as herein used, includes not only mammals, but fish, fowl, crustaceans, mollusks and all other animals used for food." Any meat which corresponds to this definition will be safe for food. Any meat which falls short of it in any degree will be dangerous.

Animals may be inspected before or after slaughter. If in-

spected before slaughter, they should present clear eyes, nostrils free from secretion, smooth coat free from sores or scabs, and at least a moderate amount of fat. Practically the same points apply to poultry.

Injured or fatigued animals, those too young or too old, just before or just after parturition, or those which have died of old age or other causes, are unfit for food.

The symptoms of the more important diseases which should condemn animals for food purposes are as follows:

Septicemia and Pyemia.—These are general diseases, evidenced by abscesses, prostration, and fever.

Rinderpest (Cattle Plague).—Prostration, shivering, discharge from eyes, nose and mouth and loss of appetite.

Anthrax.—Localized anthrax is shown by the carbuncles, boils and pustules as in human anthrax. General anthrax by the large pulpy spleen. In case of doubt, a microscopic examination of the pus or fluid from the spleen, and if the case is positive the slaughter-house or yards should be condemned until thoroughly cleaned and disinfected. This disease is highly dangerous both to man and all animals which are used for food, and the flesh of infected animals may convey the disease through the medium of bacilli or spores not destroyed in cooking.

Tuberculosis.—This infects almost all parts of the animal, though the muscles but rarely. It is to be recognized by the tuberculin test in its earlier stages, but in the later stages, the rough coat, emaciation, cough, weakness and loss of appetite, together with the elevated temperature allow the diagnosis to be made by inspection, at least so far as to condemn the animal for food.

Texas Fever.—High fever, prostration, drooping ears and tail, with hind legs under body. The disease is due to an infection by a protozoön (*Pirosoma*), and is not communicable to man as such, but the feverish condition of the animal renders it unfit for food.

Pleuro-pneumonia.—The symptoms are cough, high temperature, and difficult breathing. The disease is limited to the chest and is said not to render the meat unfit for food, but it should ordinarily be condemned, nevertheless.

Foot and Mouth Disease.—The distinctive symptom of this disease is the appearance of small pustules around the hoofs and mouth of the animal, with rough coat and elevation of temperature.

Both meat and milk may convey the infection, which is occasionally fatal in very young children. The meat should be condemned.

Sheep-pox.—This is to be recognized by the high temperature, the "flea-bitten" coat in the early stage and later by the pustules or scabs.

Liver Flukes, "Sheep Rot," "Measles," Trichinosis.—These diseases are described at some length in Chapter XVIII. If the disease is not too pronounced, animals carrying these parasites are fit for food, provided the meat is thoroughly cooked. Unless this is done by "processing" the meat at the abattoir, the meat should be condemned, since in the hands of careless cooks it might be served without sufficient cooking.

Hog Cholera.—To be known at once by the diarrhea. Such animals are unfit for food.

After Slaughter.—Good Meats are uniform in color, neither too dark red nor too pale, firm and elastic to the touch and moist but not wet. It should neither pit nor crackle on pressure, and should have the fat distributed in a marbled appearance through it. The odor should not be unpleasant, and the reaction should be slightly acid to litmus. The fat should be firm and white, without running.

Beef.—This is bright red and firm, and more marbled than other meats.

Veal.—Paler than beef and not so firm. It should be from animals not less than six weeks old. Unborn or "bob" veal is sometimes sold. It should be condemned and the vendor prosecuted.

Pork.—Pale like veal, but the fat is firmer as well as the lean.

Mutton.—Dark red and firm, with hard fat, whitish or yellowish in color.

Horse-flesh.—Coarser and darker than beef, not marbled, and when cooked, sweetish in taste. There is no objection to its sale if sold as such, provided it is from healthy animals.

Bad Meats.—Meats which are dark in color or purplish are probably from animals improperly killed and bled, or from animals killed by crowding in the car or choked to death. If they are flabby, wet, or sodden, with alkaline reaction to litmus they are decomposed, and should be condemned. The same is true if they crackle on pressure, showing gas in the tissues, or if the flesh tears easily, or the fat is yellow and soft.

Fish.—Good fish should be firm and elastic to the touch, and if held by the middle should remain rigid. The gills should show

a bright red color and be moist; the eyes should be clear and the overlying skin transparent. The odor should not be unpleasant, and the fish should sink if thrown into water. Floating is evidence of decomposition of dressed fish and of all species not having large swimming bladders. The inspector should be on the watch for dealers who attempt to give stale fish an appearance of freshness by painting the gills with blood.

Preservatives, especially sodium sulphite, are used not to make the goods keep but to improve the appearance of stale materials. Sulphites give to meats, especially such chopped meats as sausage and Hamburg steak which are often made of stale scraps, a redness like that of fresh material. Samples of any suspected goods should be taken and turned over to a chemist for analysis.

Milk and Dairy Products are the subject of a special chapter (Chapter XXXV).

Fruits should be carefully inspected for over-ripeness, greenness, or decomposition. Some dealers ripen fruit in cellars, bedrooms or other unfit places, and polish the skin by rubbing it with a filthy cloth, sometimes with spittle as a lubricant. Fruit which has been frozen should be guarded against as very apt to produce intestinal derangements.

Green Vegetables are to be condemned if badly wilted, or if marketed in the winter, frozen.

Roots, such as potatoes, carrots, dried onions and so on, should be condemned if frozen or decayed. Potatoes which have sprouted should not be sold for food, and the same is true if sunburned, as they are bitter and develop an alkaloidal poison known as *solanine* which is capable of producing severe symptoms and death.

Cereals are to be condemned if mouldy or weevilly. This is also true of cereal products of all kinds, such as bread, pastry, crackers, and breakfast foods.

Eggs, should be candled before sale and graded. Those grades which show large aircells, blood-spots, cracks and so on are not desirable as human food, but should find a place in the arts. Broken eggs in cans are almost always made from eggs of or below the grade of "thirds" and are sold by the packers for use in the arts. If found in bakeries, they should be seized. If brought across an interstate line, it will be very often a matter for the United States courts.

Health of Employees.—It goes without saying that persons suf-

fering from tuberculosis, any of the acute infectious diseases, or known to be carriers of typhoid, dysentery or any of the intestinal infections, must not be permitted to handle or sell food products. Many epidemics of various kinds have been traced to this source, and purveyors of food should never be overlooked in the search for the cause of an epidemic.

Food Poisoning.

Laboratory examinations in cases of suspected food poisoning are not often rewarded with definite results. This is due in part to the difficulty in getting the material in proper condition, in part to technical difficulties in the way; and in part to the confusion which still exists in regard to the organisms which cause food poisoning. It is generally recognized that *B. enteritidis, B. botulinus* and possibly a few other bacteria are capable of causing the production of powerful toxins in food products, especially those rich in proteids, in which they grow, but numerous cases arise in which none of these recognized organisms can be found.

When food suspected of causing poisoning is to be examined, as large a piece of the suspected material as possible should be sent to the laboratory. It should be wrapped in sterile cloths, sealed in a sterile, water-tight container, a fruit jar, for example, and packed in ice if it is not to be examined immediately. Every effort should be made to prevent any further contamination with extraneous bacteria which will only make the examination more difficult. At best, the examination may only lead to indefinite results; but no health officer should allow a case of food poisoning in his jurisdiction go without some investigation, including laboratory examination where possible.

Responsibility and Opportunity.

Health officers frequently do not realize either their responsibilities or their opportunities in connection with this kind of work. Scarcely any line of sanitary work is more important or more prompt to yield results in decreased sickness- and death-rates. Valuable assistance can often be secured from civic organizations for sanitary food work. One most excellent way of raising the standard of food-producing or handling establishments is the use of a "white list" in which are entered the names of all those food-merchants whose places grade "good" or better. These merchants

are given a white card to hang in their windows, and the list is published. The necessary publicity soon forces those who cannot grade up to the standard to improve their places until they can, or forces them to quit business.

CHAPTER XXXV.

MILK.

The proper production and care of milk is an absolute necessity of modern civilization, and the enforcement of regulations designed to secure a proper milk supply is probably the greatest single factor in reducing infant mortality.

To this end a complete sanitary survey should be made not only of the dairy farm, but of the milk routes and every place where contamination or over-heating of the milk is possible. The appended rules of the Indiana State Board of Health were first adopted by the Indiana State Dairy Association, and represent only the standards which practical dairymen are willing to require. Yet these rules, if everywhere enforced, are sufficient to secure a uniformly sound milk supply and thereby save thousands of infant lives sacrificed under present slipshod and careless methods. A detailed schedule for grading dairies, founded on the United States Agricultural Department score-card will be found in the Appendix. By its use even an inexperienced health officer can make a good sanitary survey of a dairy.

RULE 4. Regulating the Sanitation of Dairies and the Sale of Milk and Cream.—Par. 1.—No building shall be used for stabling cows for dairy purposes which is not properly constructed, well lighted, well ventilated, and provided with a suitable solid floor of plank, cement or other impervious material that can be readily cleaned, and laid with proper grades and channels to carry off all drainage.

Par 2.—No water closet, privy, cesspool, urinal, inhabited room or work shop shall be located within any building or room for stabling cows, or for the storage of milk or milk products; nor shall any fowl, hog, horse, sheep, goat or other animal be kept in any room used for milking or for storing milk or milk products.

Par. 3.—All rooms and stables in which cows are milked shall be thoroughly clean and in good repair, and shall be painted or whitewashed once each year.

Par. 4.—All manure shall be removed daily from the room or stable in which cows are milked, and shall not be stored where odors from the same will be noticeable at the stable or milk room.

Par. 5.—All persons keeping cows for the production of milk for sale shall cause each cow to be kept clean and groomed.

Par. 6.—Every person using any premises for keeping cows shall cause the yard or pasture in connection therewith to be provided with a proper receptacle for drinking for such cows, and none but fresh, clean, pure water shall be stored in such receptacle.

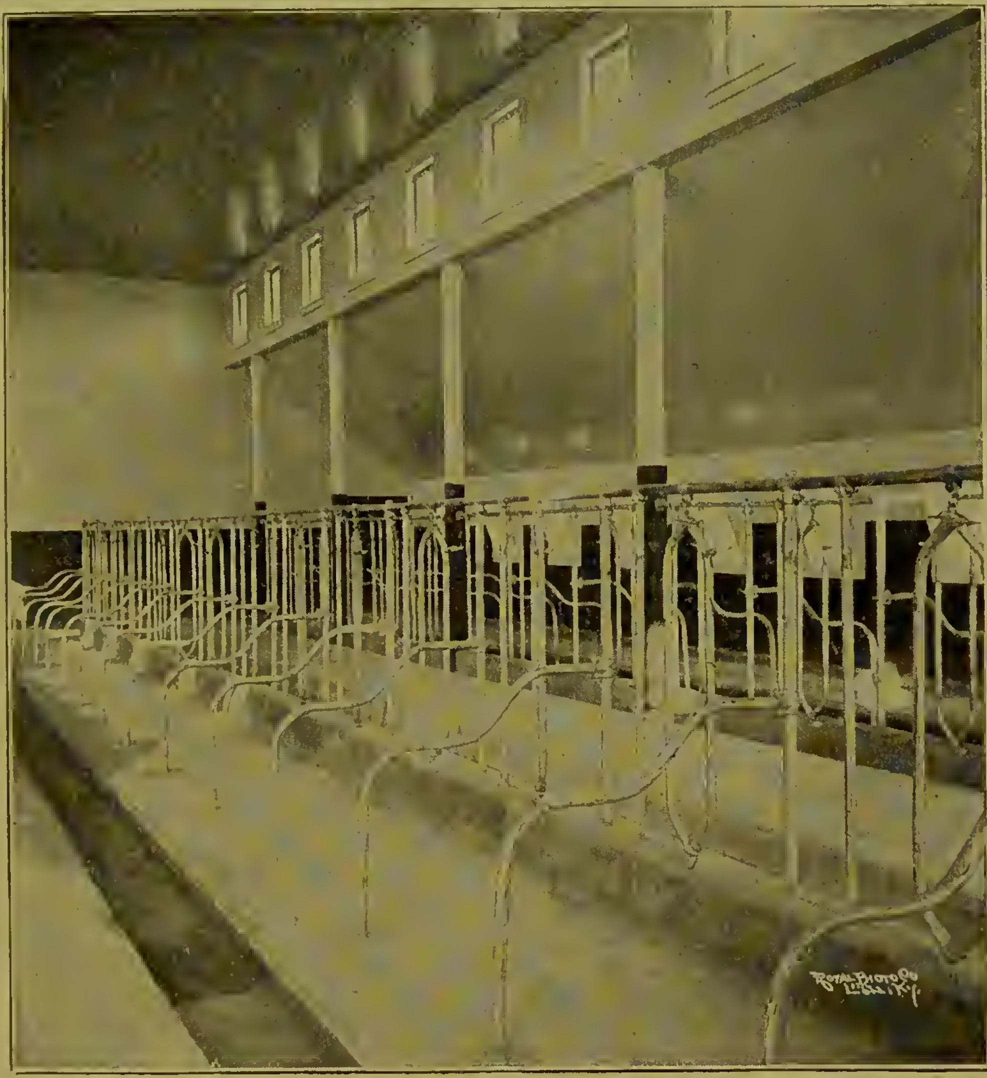

Fig. 33.—Sanitary cow barn. "Where cleanliness is a religion." (Courtesy, Dr. Henry E. Tuley.)

Par. 7.—Any inclosure in which cows are kept shall be graded and drained so as to keep the surface reasonably dry and to prevent the accumulation of water therein, and no garbage, urine, fecal matter or similar substances shall be placed or allowed to remain in such inclosure, and no open drain shall be allowed to run through it.

Par. 8.—All milk shall be removed, as soon as drawn, from the stable to the milk room. The milk room shall be separate from the stable in which

the cows are kept, and shall not be used as a living or sleeping room, but shall serve for the handling and keeping of milk and cream exclusively. It shall be sanitary in construction, properly screened, supplied with proper ventilation, light and pure water, and suitable facilities for straining, cooling and storing milk or milk products, and for washing and sterilizing all utensils and apparatus in which milk is removed, stored and delivered.

Fig. 34.—Immaculate milking conditions. (Courtesy, Dr. Henry E. Tuley.)

Par. 9.—All utensils used for the reception, storage or delivering of milk or cream shall be made of glass, stoneware, glazed metal or tinplate free from rust and of sanitary construction.

Par. 10.—All cans, pails, strainers, coolers, dippers, separators, bottles, churns, butter workers, and other dairy utensils shall be cleansed from all remnants of milk and scalded with boiling water or live steam after each use.

Par. 11.—All milk shall be strained through clean 80-mesh wire strainers,

or properly sterilized cloth, and shall be cooled to 60° F. or below within one hour after it is drawn from the cow. It shall be kept at 60° F. or below, until it leaves the farm, and if retailed to consumer, until delivered. Warm milk shall not be mixed with cold, but shall be kept in separate vessels until properly cooled.

Par. 12.—All milk or cream cans delivered to creameries or dealers in cities shall be covered with tight fitting lids, and when conveyed in open wagons shall be covered with clean canvas while being so conveyed.

Par. 13.—No person, firm, association or corporation buying, storing or receiving milk for the purpose of selling the same for consumption as such, or for manufacturing it into butter, cheese, ice cream, condensed milk or other human food, shall keep the same in utensils, cans, vessels or rooms that are unclean, or have unsanitary surroundings or drainage, or under conditions favorable to unhealthfulness or disease, and milk to be sold for consumption as such, within one hour after receiving the same, shall be cooled to a temperature not higher than 60° F., and shall be kept at such temperature until delivered.

Par. 14.—Every person engaged in the production, storage, transportation, sale, delivering or distribution of milk, immediately on the occurrence of any case or cases of infectious disease, either in himself or his family or amongst his employees or their immediate associates, or within the building or premises where milk is stored, sold or distributed, shall notify the secretary of the city board of health.

Par. 15.—No person having an infectious disease or recently been in contact with a person having an infectious disease, shall milk or handle cows, measures or other vessels used for milk or milk products intended for sale until all danger of communicating such disease to other persons shall have passed, as determined by the secretary of the city board of health.

Par. 16.—No vessels which have been handled by persons suffering from infectious diseases shall be used to hold or convey milk until they have been thoroughly sterilized.

Par. 17.—No bottle, can or receptacle used for the reception or storage of milk shall be removed from a private house, apartment or tenement wherein a person has an infectious disease until such bottle, can or receptacle shall have been properly sterilized under the direction of the secretary of the city board of health.

The following extract from the Rules of the Indiana State Board of Health gives the standards prescribed in that State for milk and milk products, which vary only slightly from those of other States and from those of the Public Health Service, so may be taken as a type:

Par. 1.—*Milk* is the fresh, clean lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within fifteen days before and ten days after calving, and contains not less than eight and one-half (8.5) per cent of solids not fat and not less than three and one-quarter (3.25) per cent of milk fat.

Par. 2.—*Blended milk* is milk modified in its composition so as to have a definite and stated percentage of one or more of its constituents.

Par. 3.—*Skimmed milk* is milk from which a part or all of the cream has been removed and contains not less than nine and one-quarter (9.25) per cent of milk solids.

Par. 4.—*Pasteurized milk* is milk that has been heated to a temperature of at least 145 Fahrenheit for thirty minutes or 165 Fahrenheit for thirty seconds and immediately cooled to 50 or lower.

Par. 5.—*Sterilized milk* is milk which has been heated at the temperature of boiling water or higher for a length of time sufficient to kill all organisms present.

Par. 6.—*Buttermilk* is the product that remains when butter is removed from milk or cream in the process of churning.

Fig. 35.—Babcock butter fat tester.

Test for Skimmed Milk.—Since the cream or milk fat is the most valuable portion of the milk and at the same time is the part most easily abstracted, the sanitary officer will do well to be on his guard against partly skimmed milk being sold for whole milk. He will be able to make this test very readily with the small Babcock apparatus which is nowadays to be found on any up-to-date farm. This costs from $10.00 to $15.00 to install and practically nothing for maintenance thereafter.

Chemical Analysis.—The chemical analysis of milk includes the determination of the percentage of fat, proteid and sugar in milk and the detection of any preservatives or coloring matter. Chemical examinations of milk are, therefore, of more economic than sanitary importance. They are usually made with the object of ascertaining whether the dairyman conforms to the law in furnishing milk which contains the prescribed per cent of fat and is free from prohibited preservatives.

Samples of milk intended for chemical analysis should be obtained as nearly as possible in the manner in which it is received by the ordinary consumer. If milk sold in bulk is to be examined it should be stirred until the cream is thoroughly mixed before taking the sample. It

is important that milk for chemical analysis be kept sweet until examined. An analysis of sour milk cannot be as accurate and as fair as an analysis of sweet milk. If it cannot be examined for several hours after collection, the sample should be kept packed in ice.

It is unnecessary to discuss the interpretation of the results of a chemical analysis of milk. The legal chemical standards for milk vary in different cities and states. The health officer should acquaint himself with these requirements in his own jurisdiction. When he receives from the chemical laboratory a report showing that the milk furnished by a certain dairy is not up to the standard, his duty under the law is usually clear.

Preservatives.—The use of illegal preservatives in milk is very much less common than it was a few years ago. In case their presence is suspected in a sample of milk, it should be set to one side in a warm place for 48 hours, and if by that time it has not soured, the use of a preservative is pretty certain and samples should be sent to the State Laboratory, or the following tests used:

Test for Formaldehyd in Milk.—Commercial sulphuric acid to which has been added 5 drops of tincture of the chloride of iron to the ounce is the reagent. A half-inch layer of this is put into a test tube and the milk flowed on top. After a few minutes a violet color develops in the milk. The test should first be tried with milk known to contain formaldehyd and after the reaction is understood, it will be found very easy to apply.

Boric Acid and Borates.—Milk containing boric acid or borates colors tumeric paper brown.

The great objection to the use of preservatives is that they inhibit only the milk-souring *Bacillus lactis* without interfering to any great extent with many pathogenic bacteria.

Test for Coloring Matter.—The presence of foreign coloring matter in milk is easily shown by shaking 10 c. c. of the milk with an equal quantity of ether; on standing, a clear ether solution will rise to the surface; if artificial coloring matter has been added to the milk, the solution will be yellow colored, the intensity of the color indicating the quantity added; natural fresh milk will give a colorless ether solution. (Testing Milk and its Products, Farrington and Woll, p. 244.)

Composition.—The milk from cows of different breeds contain the same ingredients, but in different proportions, as shown by the following table, the results of quantitative analysis:

	DURHAM OR SHORT-HORN	DEVON	AYR-SHIRE	HOL-STEIN FRESIAN	JERSEY	BROWN SWISS	COM'ON NATIVE
Fat	4.04	4.09	3.89	3.2	5.22	4.0	3.69
Sugar	4.34	4.32	4.41	4.33	4.84	4.30	4.35
Proteid	4.17	4.04	4.01	3.99	3.58	4.00	4.09
Mineral matter	0.73	0.73	0.73	0.74	0.73	0.76	0.76

Leach gives the following analysis showing the composition of milk of the human and a number of different animals:

NUMBER OF ANALYSES	KIND OF MILK	SPE-CIFIC GRAVITY	WATER	CASE-IN	ALBU-MIN	TOTAL PRO-TEIDS	FAT	MILK SUGAR	ASH
800	Cow's milk:								
	Minimum	1.0264	80.32	1.79	0.25	2.07	1.67	2.11	0.35
	Maximum	1.0370	90.32	6.29	1.44	6.40	6.47	6.12	1.21
	Mean	1.0315	87.27	3.02	0.53	3.55	3.64	4.88	0.71
200	Human milk:								
	Minimum	1.027	81.09	0.18	0.32	0.69	1.43	3.88	0.12
	Maximum	1.032	91.40	1.96	2.36	4.70	6.83	8.34	1.90
	Mean	—	87.41	1.03	1,26	2.29	3.78	6.21	0.31
200	Goat's milk:								
	Minimum	1.0280	82.02	2.44	0.78	—	3.10	3.26	0.39
	Maximum	1.0360	90.16	3.94	2.01	—	7.55	5.77	1.06
	Mean	1.0305	85.71	3.20	1.09	4.29	4.78	4.46	0.76
32	Ewe's Milk:								
	Minimum	1.0298	74.47	3.59	0.83	—	2.81	2.76	0.13
	Maximum	1.0385	87.02	5.69	1.77	—	9.80	7.95	1.72
	Mean	1.0341	80.82	4.97	1.55	6.52	6.86	4.91	0.80
	Mare's milk:								
	Mean	1.0347	90.78	1.24	0.75	1.99	1.21	5.67	0.35
5	Ass's milk:								
	Mean	1.036	89.64	0.67	1.55	2.22	1.64	5.99	0.51

Analysis of Milk.

Milk Supply and Infant Mortality.—The quality of the milk supply of a community stands in such close relation to the rate of infant mortality that every health officer should have a definite understanding of what is required in the production and delivery of clean milk. Bacteria are so ubiquitous and milk is such an excellent culture medium for their growth that it is necessary to

watch every event in the "long haul" from the cow to the consumer in order to detect the source of any contamination that may occur.

Inspections.—To determine the quality of a given milk supply it is necessary to make a thorough sanitary survey of the dairy barn, the bottling establishment and the method of transmission from the dairy to the consumer, as well as to make bacteriological and chemical analysis of samples of the milk itself. The most rigid control of dairies is not sufficient to insure a pure milk to the consumer, inasmuch as the product may become grossly contaminated from improper handling by middle men. These sanitary features are beyond the purpose of this chapter which must be limited to a discussion on the part the laboratory can play in detecting evidences of impurities in milk.

Milk Samples.—A sample of milk for either bacteriological or chemical examination should be taken as nearly as possible in the way in which it is received by the consumer.

If it is sold in bottles, an unopened bottle should be taken. If sold in bulk, it should be obtained in a wide-mouthed sterile bottle after first thoroughly stirring the milk in the container. Bottles similar to those used for samples of water are suitable for this purpose. If the sample cannot be examined in less than an hour it should be kept packed in ice until the examination can be made. If milk is kept at room temperature for 2 or 3 hours, the number of bacteria will have enormously increased, and the proportions of the various kinds of organisms present may be completely changed.

"If milk from individual cows is being collected, the teats and the milker's hands should be washed or disinfected. In some cases it is necessary to collect a separate sample from each quarter of the udder, while for a complete examination fore, middle and end milk samples should be collected." (Kenweed.)

The bacteriological and microscopical examination of milk is utilized to determine the general bacterial content of the milk, especially the degree of contamination with fecal matter; to discover whether certain pathogenic organisms, such as *B. tuberculosis,* are present; and to determine the healthiness of the udder of the cow.

Bacteriological Examinations.—The bacterial content of milk, both quantitative and qualitative is ascertained by methods exactly similar to those used in bacteriological analysis of water. Fermen-

tation tubes are inoculated with fractional parts of a cubic centimeter of milk to determine the presence of *B. Coli* and the approximate number of these organisms. Agar and gelatin plates are inoculated with dilutions of the milk and the total number of bacteria per cubic centimeter ascertained by counting the colonies developing on the plates.

Bacteriological Standards.—The bacteriological standards for milk vary in different cities. A few years ago the average bacterial counts obtained in the milk of most cities was very high, ranging from 2,300,000 bacteria per cubic centimeter of milk in Boston to 7,000,000 bacteria per cubic centimeter in the milk sold in Wilmington, Delaware. As a result of numerous bacteriological examinations and public agitation the milk situation in all the large cities of the country has greatly improved. In the smaller towns and villages where there is no pretense of sanitary control of the milk supply, conditions are still exceedingly bad, much worse, no doubt, than conditions in Wilmington, Delaware, several years ago.

There is no universally recognized standard for the maximum bacterial content allowable in milk. It would be well, however, for "health officers to aim to keep the general milk supply below the 100,000 mark." For infant feeding, 10,000 bacteria per cubic centimeter should be the maximum.

The discovery of pathogenic bacteria in milk is a matter of great difficulty and negative results have practically no value. Typhoid and diphtheria bacilli have been found in milk, but only on extremely rare occasions. The search for tubercle bacilli is more often successful. This is accomplished by means of centrifuging large amounts of milk, up to one pint, and injecting the sediment into a guinea-pig. If tubercule bacilli are present in the milk the animal will usually succumb to tuberculosis in six to eight weeks. If the animal does not die in this time it is either killed and examined post mortem, or injected with tuberculin which will reveal the existence of a non-fatal tuberculous process.

Tubercle Bacilli.—In regard to the presence of tubercle bacilli in milk, recent investigations have shown that cattle which react to tuberculin do not necessarily throw off tubercle bacilli until the development of "open" lesions; that milk from cows with "open" lesions of the respiratory, alimentary or genito-urinary tracts is usually found to be accidentally infected with tubercle bacilli; and that milk from cows with tuberculous udders is always infected.

Milk and Epidemics.—That milk has been the carrier of infection in a large number of epidemics has been frequently proved by circumstantial evidence and, in a few rare instances, by direct evidence. In 1909, Trask was able to collect from the literature reports of 317 epidemics of typhoid fever (including reports of 138 epidemics previously collected by Busey and Kober), 51 epidemics of scarlet fever, and 23 epidemics of diphtheria that were traceable to milk. Park and Krumwiede have analyzed 1038 cases of tuberculosis in which the type of infecting organism was positively determined and conclude that "the evidence of bovine tuberculosis is practically a negligible factor in adult tuberculosis. In children, however, it causes a considerable percentage of cervical

Fig. 36.—A sample of the unsuspected but dangerous tubercular cow. Rejected by the veterinarian after test.

adenitis requiring operative interference; in young children an appreciable amount of fatal tuberculosis is caused by such infection."

Leucocytes.—Milk normally contains leucocytes. The number present in the milk of perfectly healthy cows varies not only with the individual cow, but also with the same animal at different times. It is very difficult to determine the dividing line which will enable one to say that this milk contains only normal leucocytes and that contains pus. If, in the judgment of the bacteriologist, a given sample of milk contains pus the use of the milk should be at once discontinued. If the sample was composed of the mixed milk of a herd, it will only be necessary to discover and exclude the offending cows.


A


B

Fig. 37.—Sanitary milk pails. A, Gurler milk pail. Gauze fits over opening with layer of cotton between. B, Hooded milk pail.

The milk pail should be so constructed as to be easily cleaned. The cover should be so convex as to make the entire interior of the pail visible and accessible for cleaning. The chief aim being to keep dirt out of milk, and as much comes from the cow's skin and tail, the buckets which have a small opening at the top and more at the side than in the middle, allow the milk to be drawn into it easily and prevent the dirt and hair dropping into it.

The pail should be made of heavy seamless tin, and with seams which are flushed and made smooth by solder. Wooden pails, galvanized-iron pails, or pails made of rough, porous materials, are forbidden. All utensils used in milking should be kept in good repair.

Visible Dirt.—The presence of visible dirt in milk is sufficient in some states to condemn it without the necessity of determining its exact character and source. Examined microscopically the "dirt" may show black and brown masses of amorphous material, vegetable cells, masses of cellulose, vascular spirals from plants, hairs, textile fibers, etc. The presence of masses of vegetable cells and vascular spirals from plants furnishes strong evidence of fecal contamination.

CHAPTER XXXVI.

WATER.

WATER ANALYSIS.

Sanitary analysis of water is undertaken to "gauge its freedom from organic contamination, and to estimate its suitability for drinking purposes." Such an analysis involves a sanitary survey of the source of the supply, and bacteriological and chemical examinations of samples of the water itself. Consideration of all the facts obtained from all three sources is essential to the determination of the safety of a given water for drinking purposes. "In sanitary water analysis the factors involved are so complex and the evidence necessarily so indirect that the process of reasoning much more resembles a doctor's diagnosis than an engineering test." (Prescott & Winslow.)

Complete Survey Necessary.—A health officer can make no more grievous mistake in the presence of an epidemic of typhoid fever or dysentery than to rely upon a single bacteriological or chemical analysis of the water supply to reveal the source of the infection. In such a case a careful survey of the situation as a whole should be made before submitting any kind of sample for laboratory examination. It should be remembered that by the time the effects of pollution show themselves in the form of illness in the users of the water, the source of the pollution may have entirely disappeared.

How unreliable a single examination of water may be is shown by the following occurrence. In April, 1910, an epidemic of typhoid fever broke out in one of the state institutions of Indiana. The officers and their families as well as the inmates were affected. A careful survey of the whole situation pointed either to milk or water as the source of the infection inasmuch as these were the only things used in common by the officers and their families and the inmates. A bacteriological examination of the institution's water supply, which came from a large spring on the grounds, on April 29, showed nothing in the least suspicious. A sample taken later

in the afternoon of May 2, gave a presumptive test for *B. Coli*. Another sample on May 7, proved to be excellent so far as bacteriological examination was concerned. It was then learned that on the morning of May 2, the sewers of the institution had been flushed out under considerable pressure. On May 20, samples of water taken at 6:00 A. M. and 6:00 P. M. showed no evidence of contamination. The sewers were flushed shortly before noon on the same day. A sample of water taken at 6:00 A. M. May 21, showed such abundant pollution that *B. Coli* was isolated from the water and identified in cultures. It was learned afterward that about two weeks before the outbreak of the epidemic the sewers had been flushed for the first time in more than a year.

Bacteriological Water Analysis.

Bacteriological analysis of water is both quantitative and qualitative. Quantitative estimations show the total number of bacteria which are capable of growing on artificial culture media. Daily or weekly quantitative estimations will determine the normal bacterial content of a given water supply and will reveal any unusual variation from this normal content. Qualitative examinations "determine the nature of the organisms, and especially whether they are such as to be found in excreta from the body," that is, they reveal potential and in rare instances actual danger.

It is not intended that this chapter serve as a laboratory guide. Only those facts concerning bacteriological and chemical analysis will be given which concern the health officer on the field, such as the manner of collecting and preparing samples and the interpretation of results as reported from the laboratory. Laboratory methods will be referred to only in so far as they will aid the health officer in understanding results.

Samples.—Bacteria are everywhere present, hence the most rigid precautions are necessary in taking a sample of water for bacteriological examination to avoid the introduction of extraneous organisms. Obviously, a bacteriological analysis of a sample of water taken in any but an absolutely sterile container will be worse than worthless. Sterile bottles holding at least 100 c.c. and having ground glass stoppers are furnished by laboratories for collecting specimens of water. These alone should be used for this purpose.

If the sample is to be taken from a stream or lake, the bottle should be pushed beneath the surface to a sufficient depth to avoid

surface contaminations before removing the stopper. If taken from a pump, sufficient water should be pumped out to at least avoid water that has been standing in the pipes. If the sample is from a hydrant allow the water to run for 10 or 15 minutes before filling the bottle. In other words, "the water should always be collected for analysis just as it is ordinarily obtained for drinking purposes."

If the water cannot be examined at once it should be packed in ice until it reaches the laboratory. Public health laboratories, as a rule, furnish outfits for collecting and transmitting specimens of water for bacteriological examination. These are arranged for refrigerating the samples during transit and these outfits alone should be used in sending specimens to laboratories.

Information to Accompany Sample.—Along with the sample certain definite information should be sent. This is necessary to a proper interpretation of the results of the examination. The following facts concerning each specimen should be stated: Name and address of the sender; reason for the analysis; source of the sample; place, date and hour of collection; character of the soil and subsoil of the district; rainfall during the previous week; nature and distance of any evident or possible source of pollution; any cases of sickness among the users of the water that cast suspicion upon it as the source of infection, etc.

Examination in Laboratory.—When the sample reaches the laboratory, dilutions of the water of 1 to 100, 1 to 1000, etc., are made in sterile water. One cubic centimeter of the dilution is placed in each of several Petri dishes. Cooled, melted agar-agar or cooled melted gelatin is poured into the dish, thoroughly mixed with the water and allowed to harden. The total number of colonies of bacteria developing on a plate after 24 to 48 hours, multiplied by the dilution gives the total number of bacteria in a cubic centimeter of the original water.

It should be distinctly borne in mind that all quantitative estimations of the number of bacteria in a sample of water are approximate only. In the first place, it is practically impossible to get a single sample, especially from a large body of water, that will represent a fair average of the whole. Furthermore, many bacteria formed in water will not grow at incubator temperature. Finally, quite marked changes in the bacterial content of a sample of water will occur in transit even though it be packed in ice. If the sample

is not packed in ice these changes become so great as to entirely vitiate the results of a quantitative bacteriological estimation. There is, therefore, no recognized standard of safety for water based upon quantitative bacteriologic examination. For after all, the kind of bacteria present in a water is more important than the number.

Qualitative Bacteriological Examination.—The kinds of bacteria present are determined by qualitative examinations. These consist in determining either by presumptive tests or by actual isolation and identification, the presence of bacteria not necessarily harmful in themselves (e.g., *B. Coli*), but which on account of their origin are especially likely to be associated with bacteria that are pathogenic. In very rare instances the pathogenic bacteria (*B. typhosus* or *Vibrio choleræ*) have been isolated from water. This is a feat so rare of accomplishment, however, that no bacteriologist makes such an examination as a matter of routine.

"Coli" Test.—The presumptive test for *B. Coli* is carried out by means of inoculating fermentation tubes of dextrose or lactose broth (with or without litmus or neutral red), with amounts of the water ranging from 0.001 of a cubic centimeter to 1 c.c. The presence of gas in any of the tubes is taken to indicate the presence of *B. Coli*, and the number of colon bacilli per cubic centimeter of water can be roughly estimated from the smallest quantity that will cause the production of gas.

In some laboratories the water is inoculated into special "enrichment media" which favor the development of *B. Coli*. After incubation, cultures are made from the special media on some of the different plate media, such as Endo's. In this way, a skillful bacteriologist is very frequently able to pick off and positively identify colon bacilli. This method of isolation and identification of *B. Coli* from samples of water is now carried out as a matter of routine in many laboratories.

On the value of the colon test there is still difference of opinion. The mere presence of this organism in water is not absolute proof of pollution with human excreta, for these same organisms are also found in the intestines of domestic animals. From the public health point of view it is safe, however, to conclude that the presence of colon bacilli in water in considerable numbers always points to sewage contamination; even waters with one colon bacillus in 10 c.c. should be regarded as suspicious. The absence of *B. Coli*, especially

if "enrichment media" are used, is a reliable index of purity of the water.

Chemical Analysis of Water.

At least 1 gallon of water is necessary for complete chemical analysis. This should be sent in a large protected bottle or demijohn which has been carefully cleansed. A specimen for chemical analysis should never be sent in a stone jug, tin can, or wooden vessel. Before filling the bottle it should be rinsed with some of the water that is to be sent for examination. It is necessary, also, that information on the same points mentioned under Bacteriological Water Analysis accompany the specimen. A chemical finding which is quite normal in one locality may be evidence of pollution in another. The substances examined for in chemical analysis of water are free ammonia, albuminoid ammonia, nitrogen as nitrates and nitrites, and chlorine.

Free ammonia is present in rain water and is of no significance there. In subsoil waters, its importance depends much upon associated compounds. If found alone it has little or no sanitary significance. If associated with a considerable amount of chlorine, it usually indicates pollution with urine, the urea of which has undergone ammoniacal decomposition. High free ammonia with high albuminoid ammonia, chlorine and oxidized nitrogen (nitrates or nitrites) denote animal pollution.

Albuminoid ammonia alone or with mere traces of free ammonia indicates vegetable contamination.

The importance of *chlorine* in water depends very largely upon the source of the sample. If taken from a well on the seacoast or from soil known to be rich in chlorides, it is of no sanitary significance. In an ordinary inland well, an excess of chlorine indicates pollution with household slops or sewage.

The presence of *nitrates* and *nitrites* in water is practically positive evidence of pollution. Nitrates indicate potentially dangerous bacterial pollution at some past time; the water may or may not be dangerous at the time the sample is taken. Nitrites denote the same bacterial activity in process of accomplishment and are therefore always danger signals.

There are no recognized chemical standards by which a water can be unqualifiedly condemned or passed as pure. The following table, modified from Harrington, indicates the proportion of

chemical substances actually found in samples of waters known to be good and bad respectively:

	Parts per 100,000 in a good water	Parts per 100,000 in a bad water
Free ammonia	0.0002	0.4750
Albuminoid Ammonia	0.0018	0.0585
Nitrogen as nitrates	0.0240	4.0000
Nitrogen as nitrites	0.0000	0.0540
Chlorine	0.07	4.27
Volatile residue	1.25	11.10
Fixed residue	1.60	23.30
Total residue	2.85	34.40
Hardness	1.00	14.00
Appearance	Clear and bright	Clear and bright
Color	Absent	Absent
Odor	Absent	Foul after boiling
Changes on ignition of residue	No blackening	Slight blackening

CHAPTER XXXVII.

NUISANCES.

Definition.—The subject of nuisances is one which plays a large part in the daily work of the health officer, but is from a sanitary point of view of comparatively small importance. A nuisance is primarily anything which is offensive to the senses, noxious to health, or interferes with the convenience of the public. The latter class, which consists of such offenses as damming and diversion of streams or water-flows, and fencing of public grounds or roads, may be dismissed at once as not nuisances in the sanitary sense, although legally classified as such. In order that the idea of nuisance in law may be understood, the section of the Indiana statute defining it is appended in full to this chapter, which definition is very typical of the statutes of all the states.

Necessity for Investigation.—The class of cases in which the health officer is most often asked to use his authority is that in which "noxious exhalations, or noisome or offensive smells become injurious to the health, comfort or property of individuals or the public" or "offal, filth or noisome substance is collected or remains in any place to the damage, discomfort or prejudice of the public." Very frequently indeed it will be found that attempts are made to "get even" in neighborhood quarrels through the medium of the health officer. Nevertheless, it often occurs that real nuisances of a kind that may well be injurious to health, as filthy slaughterhouses, overflowing privies or dead animals are to be found, so that every case must be investigated and decided on its merits. But before the health officer issues his order for the abatement of the alleged nuisance, he must be absolutely sure that the matter really does concern either the health of the public or of some individual, otherwise he is intermeddling with what does not concern him. If he believes that the nuisance is real, but does not concern the public health, he should refer the complainant to the prosecuting attorney for relief. If he believes that the matter does tend to create sick-

ness, it is then his duty to act with vigor by issuing the order for abatement and if necessary prosecuting the offender.

Sanitary Nuisances.—Nuisances really injurious to the public health are comparatively few. Accumulations of filth which provide breeding places for flies; dead animals which nauseate the passer-by; chimneys giving off volumes of smoke charged with carbon and sulphurous gases; smelters with their fumes of arsenic, sulphur, tellurium and zinc vapors; privies and cesspools whose foul contents are likely to be transferred by flies to someone's dinner-table; manure-piles and filthy barns; filthy garbage cans and accumulations of kitchen refuse, are almost all of the nuisances which can properly be said to be injurious to the public health. Gas-works, with their odors of ammonia and aniline, glue and fertilizer factories, tanneries and oil refineries may be nuisances at law, but their odors are hardly prejudicial to health.

The legal idea is that the smell is in itself harmful, but this cannot well be except in the case of the smelter fumes and sulphur laden coal smoke alluded to above. The ammoniacal gases—hydrogen sulphide and mercaptans, arising in the course of decomposition are not in themselves harmful in any dosage which would be likely to be taken through inhalation, but the flies which are bred in decomposing substances are a source of danger, since they may carry putrefactive matters and inoculate them upon persons or food, to the prejudice of the public health, and this will be the real reason for the abatement of the nuisance. Similarly, collections of filth which are likely to pollute or do pollute water which may be used for domestic or stock water, constitute genuine nuisances, but are generally prosecuted under a separate statute.

The health officer who bears clearly in mind the limitations of his authority under the laws of his particular state with regard to nuisances, will not initiate actions without due cause and will soon cease to be sought as a means of revenge, while the one who does not will be continually involved in trivial quarrels to the detriment of the dignity of his office and his own peace of mind.

Sec. *2154*.[1]—Whoever erects, continues, uses or maintains any building, structure or place for the exercise of any trade, employment or business, or for the keeping and feeding of any animal, which, by occasioning noxious inhalations or noisome or offensive smells, becomes injurious to the health, comfort or property of individuals or the public, or cause or suffer any offal,

[1] Burns' Revised Statutes, 1901.

filth or noisome substance to be collected or to remain in any place, to the damage or prejudice of others or the public, or obstructs or impedes, without legal authority, the passage of any navigable river, harbor or collection of waters, or unlawfully diverts any stream of water from its natural course or state to the injury of others, or obstructs or encumbers by fences, building, structure or otherwise, any public grounds, or erects, continues or maintains any obstruction to the full use of property so as to injure the property of another, or essentially to interfere with the comfortable enjoyment of life, shall be fined not more than five hundred dollars nor less than ten dollars: Provided, That nothing in this section shall prevent the Board of Trustees of towns and the Common Council of cities from enacting and enforcing such ordinances within their respective corporate limits as they may deem necessary to protect public health and comfort.

CHAPTER XXXVIII.

MISCELLANEOUS SANITARY LAWS.

The states have not moved with equal pace in the enactment of sanitary laws, and some are in advance in one way, some in another. Some of these regulations are statutory in character, some are rules of State Boards of Health, and some are in force in certain states under one guise, and in other states under the other. It will be sufficient for the purposes of this chapter to call attention to them, leaving the searching out of the exact form in which they are in force for those who are especially interested in legislative work.

Common Drinking Cups.—The use of public drinking cups is forbidden by law in Kansas, Oklahoma, Illinois, Missouri and other states, and by the Public Health Service to all transportation companies engaged in Interstate Commerce. It is founded on the well-known fact that the public drinking cup is an ideal means for the dissemination of the diseases which particularly affect the mucous membrane of the throat and mouth, as syphilis, tuberculosis, pneumonia, diphtheria, and the exanthemata. Wherever it is forbidden to use public drinking cups, a trade promptly springs up in the paraffined paper cups sold at one cent each, and in folding metal cups. Besides its directly sanitary features, the esthetic side of the movement is not to be neglected, and it has also an educational value beyond the direct and immediate results obtained.

Anti-Spitting Ordinances.—Such regulations are rarely if ever statutory, but depend on municipal ordinances or orders of boards of health, state or local, for their force. They forbid spitting on sidewalks, gratings, stairs, halls, in street, traction or railway cars, and other public places. They have not the slightest value unless enforced, and unfortunately they are rarely enforced at all times in any place. The sputum may convey many diseases through the agency of flies which carry the germs to food or drink, and a smaller number by dust infection. Light and drying have a tend-

ency to render sputum innocuous after a time, but that is no reason for not enforcing all regulations of this character.

Marriage Laws.—Certain of the states have adopted laws forbidding the marriage of the insane, feeble-minded, epileptic, tubercular and syphilitic. It would be a wise thing from the point of state-craft if such laws were in force everywhere, but unfortunately against the first three classes named, the only result which would be likely, is an increase in illegitimate offspring. Feeble-minded women in some states are required to be kept isolated in institutions until after the menopause, and the same rule might well apply to both sexes among the insane and epileptic, without being made absolute. In selected cases also, the following statute works well.

Sterilization Law.—In 1907 the legislature of Indiana passed a law which has since been adopted in substance by a number of states, under which, in any institution in the state entrusted with the care of "confirmed criminals, idiots, imbeciles and rapists" a board of experts consisting of the institutional physician and two other physicians, acting on the recommendation of the institutional board of managers, is given authority to perform such operation for the prevention of procreation as may be decided safest and most effective, provided that they shall decide that the person is unimprovable. This is a wise law, and worthy of much wider use than has yet been made of it. The ordinary operation done by its authority in the male is vasectomy, which in the hands of an expert is done in a few minutes time, without an anesthetic and almost without pain, and does not take the patient away from his work for more than a day. By its authority, in the case of those guilty of rape and incest, castration is said to have been performed. In the case of the female, resection of the oviducts would be the operation of choice. As this statute is in no sense penal, it is not repugnant to the section of the Constitution of the United States which forbids cruel and unusual punishments.

PART III.

LABORATORY METHODS

CHAPTER XXXIX.

PATHOLOGICAL MATERIALS.

General Considerations.—The use of laboratories in the promotion of public health work is of very recent origin. The first laboratory of hyigene was that established for Pettenkofer in Munich in 1872. Here was begun the study of the relation of water supplies to the spread of typhoid fever and cholera. By the application of facts learned in this laboratory concerning the disposal of sewage, the contamination of public water supplies, etc., to sanitary conditions in Munich, the city was changed in a few years from a hotbed of typhoid fever to a city in which von Ziemssen declared it was impossible to find a sufficient number of cases of this disease for the satisfactory teaching of medical students.

Public health laboratories differ both in organization and in purpose from those devoted to research or to teaching. In the latter, the aim is either the discovery of new scientific truth, or the illustration of the principles of a science in such a way that they may be more readily comprehended by students; in the former, the aim is the invention of methods by which facts already known can be used in the prevention of disease.

Value of Laboratories.—Laboratories may be of service in conserving the public health in at least three ways. First, by promptly discovering the earliest cases of certain infectious diseases, such as diphtheria and cholera, epidemics can be more easily prevented by taking proper measures before the disease has become widespread in the community. Second, by discovering the healthy carriers of infection, such as persons who, though they show no symptoms, discharge virulent typhoid bacilli or cholera spirilla from their bodies, or harbor diphtheria bacilli in their noses and throats. Third, the laboratory can often supply positive proof of the source

of an epidemic of typhoid fever or other infectious disease, thus furnishing a rational and imperative demand for its removal.

It is taken for granted that the physician or health officer who reads this has an opportunity to make use of a public health laboratory. Hence it is not the object of this chapter to serve as a handbook of laboratory technic. It is intended to fulfill three distinct purposes.

First, to set forth *general principles* for the proper methods of *collecting, preparing* and *sending* specimens to the laboratory in order that they may be best utilized.

Second, to give a very general idea of how specimens are handled after they reach the laboratory.

Third, to show the practical application of the results of laboratory work to the problems which daily confront the local health officer.

Collection of Specimens.—The manner in which a specimen is collected and prepared for transmission to the laboratory determines very largely the accuracy of the results of its examination. Practically all public health laboratories furnish free of charge special outfits with printed directions for collecting and sending the various kinds of specimens to the laboratory. The outfits supplied by State laboratories are usually mailable, those furnished by city laboratories in most instances are not mailable. Local health officers should acquaint themselves with the methods of collecting and preparing specimens required by their own state or city laboratories, not only that they may themselves send specimens correctly, but may be able when necessary to instruct the physicians in their jurisdiction in such matters.

Postal Laws.—The United States Postal Laws and Regulations concerning the transmission of pathological and bacteriological material through the mails are very strict and should be known to every health officer. These laws and regulations are as follows:

Section 495, P. L. and R., as amended by the Postmaster General's Order No. 3064, April 22, 1910.

Section 495, Postal Laws and Regulations, is hereby amended to read as follows:

Specimens of diseased tissues may be admitted to the mail for transmission to the United States, State, municipal or other laboratories in possession of permits referred to in paragraph 3 of this section only when inclosed in mailing cases constructed in accordance with this regulation: Provided, That

bacteriologic or pathologic specimens of plague and cholera shall under no circumstances be admitted to the mails.

2. Liquid cultures, or cultures of micro-organisms in media that are fluid at the ordinary temperature (below 45 C. or 113 F.), are unmailable. Such specimens may be sent in media that remain solid at ordinary temperature.

3. No package containing diseased tissue shall be delivered to any representative of any of said laboratories until a permit shall have first been issued by the Postmaster General certifying that said institution has been found to be entitled, in accordance with the requirements of this regulation, to receive such specimens.

4. (a) Specimens of tubercular sputum (whether disinfected with carbolic acid or not disinfected) shall be transmitted in a solid glass vial with a mouth not less than one inch in diameter and capacity of not more than 2 ounces, closed by a cork stopper or by a metallic screw top protected by a rubber or felt washer. Specimens of diphtheria, typhoid or other infectious or communicable diseases or diseased tissues shall be placed in a test tube made of tough glass, not over one-half inch in diameter, and not over three and one-half inches in length, closed with a stopper of rubber or cotton and sealed with paraffine or covered with a tightly-fitting rubber cap.

(b) The glass vial or test tube shall then be placed in a cylindrical tin box made of I. C. bright tin plate, with soldered joints, closed by a metal screw cover with a rubber or felt washer. The vial or test tube in this tin box shall be completely and evenly surrounded by absorbent cotton closely packed.

(c) The tin box with its contents must then be enclosed in a closely-fitting metal, wooden or papier-mache block or tube at least 3-16 of an inch thick in its thinnest part, of sufficient strength to resist rough handling and support the weight of the mails piled in bags. This last tube to be tightly closed with a metal screw cap.

5. Specimens of blood dried on glass microscopic slides for the diagnosis of malaria or typhoid fever by the Widal test may be sent in any strong mailing case which is not liable to breakage or loss of the specimen in transit.

6. Upon the outside of every package of disease tissues admitted to the mails shall be written or printed the words, "Specimen for Bacteriological Examination. This package to be pouched with letter mail. See section 495, P. L. and R."

DIPHTHERIA.

It is undoubtedly true that there has been a greater reduction in the mortality from diphtheria during the last fifteen years than in its morbidity. This is due to the fact that this disease is now universally treated scientifically with antitoxin, while quarantine is still administered in most communities in a haphazard irrational way. Release from quarantine should be governed by the results of bacteriological examination of subsequent cultures from the throat of the patient. An arbitrary time limit of quarantine is not justifiable

except in localities where it is entirely impossible to secure laboratory examinations.

The outfits supplied by the laboratory of the state or city in which the physician or health officer resides should alone be used in taking all cultures to be examined for diphtheria bacilli. Outfits furnished by municipal laboratories are usually non-mailable and contain a swab and media to be inoculated by the physician. Those furnished by most state laboratories consist of a double mailing case with one or two swabs but no media. The tube of media is left out because it frequently becomes old, dry or contaminated before use, resulting in loss to the laboratory or difficulty in securing reliable results, especially if the swab is destroyed by the doctor. Better results are also obtained if the medium is inoculated by expert hands.

Wooden skewers, aluminum, iron, brass or copper wire are used for making the swabs. Copper and brass give least reliable results because products of oxidation of the copper may have an antiseptic effect upon the bacteria present.

Very much depends upon the manner in which the swab is taken. The health officer should not only know how cultures are to be taken but should be able to instruct the physicians who report to him. Every laboratory furnishes directions which apply to the particular kind of outfit used, and with these the health officer should be thoroughly acquainted. The following directions are sufficiently general to apply to any type of outfit:

Throat Culture.—No local antiseptic application should be made for at least 2 hours previous to taking the culture. Patient's throat should be cleared of any adherent food particles, etc.

1. Have the patient in good light.

2. Rub the swab thoroughly against any membrane, exudate or inflamed area in the throat, *revolving* the swab in the fingers in such a way as to bring it thoroughly in contact with the suspected area.

3. *Do not lay the swab down* or allow it to touch anything other than the throat of the patient and the tube in which it is contained.

4. Return the swab to the tube, replace the cotton plug and return the tube to the case. Or, if the outfit contains a tube of culture medium—

5. Insert the infected swab into the serum-tube and rub it gently

back and forth over the entire surface of the serum, *revolving* the swab so as to bring it thoroughly in contact with the serum. Do not break the surface of the serum by pushing the swab through it. Do not use the medium if it is dry or contaminated. Replace the infected swab in its own tube and replace the cotton plugs in both tubes.

Nasal Culture.—Cultures for release must be taken from both the nose and throat in all cases. Use one of the two swabs in the outfit for the nose and the other for the throat. Cultures for diagnosis may be made from either the nose or throat, or both, at the option of the physician.

1. The physician should stand behind the patient who should preferably be in a sitting posture, if his condition allows it, place the left hand on the patient's chin and hold the head firmly against the body of the operator. With the right hand insert the swab about one-half inch upward into the right nostril. Then raise the hand so that the shaft of the swab is parallel to the floor of the nose and with gentle rotation pass the swab back to the posterior pharyngeal wall. Withdraw the swab and repeat the process in the other nostril.

2. Remove the swab and return it to the test tube, taking care that it does not touch any object other than the tube in which it is contained. Replace the cotton plug and return it to the case.

3. If the outfit contains culture medium inoculate it as described under "Throat Culture" above.

The swab should always be returned to the laboratory whether the outfit contains medium or not. It may be necessary to reinoculate the medium if the culture fails to grow.

All state laboratories are handicapped by the fact that it is usually 8 to 24 hours after the swab has been taken from the throat before it is delivered at the laboratory. This necessitates some delay in getting the report to the physician. The difficulty can be partially obviated by the method in use in many laboratories. As soon as the specimen is received, a culture is made and a smear from the swab examined. In this way, from 50 to 80 per cent of all positive specimens can be reported within an hour after they reach the laboratory. Where there is the slightest doubt as to the findings on the swab, the case is not reported until the culture has been examined. Smears are made from the cultures at the end of 6 or 8 hours and from 5 to 20 per cent more

are reported. No case can be safely pronounced negative from the swab alone.

A culture may be positive, negative, suspicious, contaminated, or may fail to grow entirely. A positive report cancels all previous negatives on the same case. A negative report may be due to (a) Absence of *B. Diphtheriæ* from the throat; (b) Failure to reach bacilli with the swab as may happen in laryngeal diphtheria and in pharyngeal cases from improper technic; (c) Failure to inoculate the medium properly, which is not likely to occur if the inoculation is done by an expert in the laboratory; (d) A very few diphtheria bacilli in the presence of many varieties may be overlooked by the bacteriologist. This is an infrequent occurrence.

When a "suspicious organism" is reported present a second culture should be sent at once. The patient should be temporarily isolated and antitoxin administered if the symptoms indicate it. In most laboratories suspicious cultures are reinoculated and reincubated when a second examination will usually give more definite results.

When the culture fails to grow no diagnosis can be made and a second culture must be sent at once. "No growth" may be due (a) to use of an antiseptic in the throat previous to taking the culture; or (b) to failure to properly inoculate the medium.

"Contamination" may occur from various sources. No diagnosis can be made and a second culture is required.[1]

The tendency on the part of many physicians to either magnify or minimize the results of bacteriologic examination is a frequent cause of unnecessary and irrational complaints which every health officer should be able to answer. That it is not safe for a physician to depend solely upon the appearance of the throat for diagnosis is shown by the records of various laboratories. At the Boston City Laboratory it was found that "when a physician makes definitely a positive clinical diagnosis at the time of taking the culture, bacilli are found in 68 per cent of the cases, and that when he makes a definitely negative diagnosis . . . bacilli are found in 11 per cent of the cases." In the Philadelphia City Laboratory, diphtheria bacilli were found in 83 per cent of cases diagnosed diphtheria clinically, in 35 per cent of those diagnosed "not diphtheria," and in 46 per cent in which the diagnosis was doubtful. At the Chicago labo-

[1] Modified from Report of Committee on Throat Cultures, Section on Preventive Medicine of the American Medical Association, *Journal American Medical Association*, 1911, LVII, 976.

ratory cultures from only 34 per cent of cases diagnosed diphtheria contained diphtheria bacilli, 13 per cent of those pronounced tonsillitis, and 8.6 per cent of those in which the physician did not venture a diagnosis. These results may be tabulated as follows:

	Indiana	Boston	Philadelphia	Chicago	Average
Clin. diag. positive.. Bact. diag. positive..	53.8%	68%	83%	34%	59.7%
Clin. diag. negative.. Bact. diag. positive..	26.2%	11%	35%	13%	21.3%
Clin. diag. doubtful.. Bact. diag. positive..	28.1%	27%	46%	8.6%	27.7%

Comparisons of clinical and bacteriological diagnosis may, however, be somewhat misleading. The physician may change his diagnosis even before he receives the report of the examination at the laboratory. Unfortunately, the failure to find *B. Diphtheriæ* in a culture does not always indicate correctly the absence of the disease of diphtheria. A very small percentage of cases of true diphtheria are negative on first culture and positive on the second or third. For this reason more than one culture should always be sent from every case of suspicious sore throat if the first culture fails to show Klebs-Löffler bacilli. The finding of *B. Diphtheriæ* in a culture does not necessarily mean that the patient has the disease of diphtheria. It does prove, however, that he is carrying the bacilli of diphtheria and is therefore a source of danger to the public.

"Carriers."—The problem of dealing with healthy diphtheria bacillus carriers is always a troublesome one. It is difficult to convince many persons that a patient who has entirely recovered from diphtheria or a healthy contact with no symptom whatever of the disease may be a source of danger to the public for days, weeks or even months. In considering this question three facts must be borne in mind: (1) that because of an immunity, natural or acquired, certain persons can harbor virulent diphtheria bacilli in their throats without suffering any impairment of health; (2) that diphtheria antitoxin neutralizes the toxin in the blood but has no effect whatever on causing the bacilli to disappear from the throat; (3) that the bacilli in the throats of healthy carriers may be highly virulent.

Wesbrook and his coworkers examined 478 children in a school in which there was an epidemic of diphtheria. They found diphtheria bacilli present in the throats of 172 children, 104 of whom (60.5 per cent) showed no symptoms of the disease. The writer found that of 264 first cultures from patients with no symptoms of diphtheria, 42 contained diphtheria bacilli. On the other hand, Park and Beebe examined the throats of 320 healthy persons who had had no direct contact with diphtheria patients and found diphtheria bacilli in 8 (2 per cent). Only two of these later developed the disease. In regard to healthy carriers, the conclusions of the "Committee of the Massachusetts Association of Boards of Health" are sufficiently correct for practical purposes, namely that "in urban communities, at least 1 to 2 per cent of well persons among the general public are infected with diphtheria bacilli and that where persons are exposed to diphtheria, as in families, schools, or institutions where cases exist, the number infected is much larger and may range from 8 to 50 per cent."

Persistence of Infection.—Woodhead found that the average period of persistence of diphtheria bacilli in the throats of convalescents was 51 days and observed no appreciable difference between patients treated with and without antitoxin. This is the longest average period of persistence of any author, the general average is in the neighborhood of 25 days. Tjaden studied 1,358 positive cases in Bremen and found 67 per cent were free from bacilli after 2 weeks, 75 per cent after 3 weeks, 84 per cent after 4 weeks, 93.4 per cent after 6 weeks. He found that diphtheria bacilli disappeared more rapidly from the throats of persons over 14 years of age than from those of younger children. Thus, 6 weeks after an attack of diphtheria, Klebs-Löffler bacilli were found in 3.5 to 3.8 per cent of patients under 14 and in only 0.7 per cent of those above that age.

That these persisting bacilli are fully virulent has been proved by innumerable observations. The longest periods of persistence of virulent diphtheria bacilli are those reported by Prip, 235 days; Schaefer, 230 days; Belfanti, 215 days. The bacilli from the throats of healthy contacts are equally virulent as shown by the following table: [1]

[1] Slightly modified from the Bacteriology of Diphtheria, edited by Nuttall and Graham-Smith, Cambridge, 1908, p. 232.

TABLE SHOWING THE VIRULENCE OF DIPHTHERIA BACILLI ISOLATED FROM HEALTHY CONTACTS.

Observer.	No. tested for virulence.	Fully virulent.	Totally nonvirulent or causing a slight infiltration.
Parke and Beebe	12	11	1
Aaser	17	17	0
Bolton	88	88	0
Mueller	12	6	6
Kober	15	15	0
Kobbett	9	6	3
Graham-Smith ..	56	38	18
Total	227	181 (80%)	28 (20%)

"These records clearly show that the majority of well persons harboring diphtheria bacilli which have been derived by contact from clinical cases, retain in their throats fully virulent organisms, and that the transference of virulent diphtheria bacilli from a diseased to an immune person does not tend to weaken its virulence."[1]

Summary.—1. The fact that a large number of cases diagnosed "not diphtheria" clinically prove positive on bacteriological examination and vice versa, demonstrates the importance of taking cultures from every sore throat, regardless of the age of the patient, or the severity of the symptoms.

2. It is likewise important in combatting the spread of this disease to take cultures from the throats of every person who has come in contact with a case of diphtheria.

3. All persons whose throat cultures contain diphtheria bacilli, whether suffering from any symptoms of the disease or not, are sources of danger to the public. They should be placed in quarantine and kept there until at least one culture shows that these bacilli have disappeared. Numerous experiments show that the bacilli in the throats of healthy contacts are almost invariably virulent.

4. The administration of antitoxin has little or nothing to do with the disappearance of diphtheria bacilli from the throat.

5. An arbitrary time of quarantine is not justifiable. Release from quarantine should be governed entirely by the results of

[1] Ibid., p. 233.

bacteriological examination of subsequent cultures from the throat of the patient.

TUBERCULOSIS.

Diagnosis.—The diagnosis of tuberculosis in public health laboratories involves the examination of sputum, urine and pus and other discharges, and tissues. While tuberculosis is spread chiefly by means of sputum, urine, pus and other discharges may become a danger to the public health through the agency of flies. In state and municipal laboratories the examination of tissues for evidence of tuberculosis is usually limited chiefly to sections of animal tissues sent by inspectors of slaughter houses.

Sputum Outfits.—The outfits supplied by most public laboratories for the collection of sputum consists of a heavy wide-mouthed bottle, with a cork stopper, and packed for mailing according to the United States Postal Laws and Regulations. (See page 342.) In the bottle is usually a 5 to 10 per cent solution of carbolic acid. It has been found by careful estimation that a patient with fairly well advanced case of tuberculosis discharges every 24 hours in his sputum from 500,000,000 to 3,000,000,000 tubercle bacilli. The handling of disinfected sputum may thus be a very real source of danger to the bacteriologist, especially if, as frequently happens, an improper mailing case is used and the bottle becomes smashed in the mails.

Directions for Collecting Sputum.—Do not pour out the solution of carbolic acid contained in the bottle. Collect the sputum in the morning before the patient has taken any food, or after a severe paroxysm of coughing. If expectoration is scanty, save the entire amount coughed up in 24 hours. Carefully avoid contents of the stomach, particles of food, etc. Give only what is coughed up from the lungs. See that the cork is inserted tightly, wash the outside of the bottle thoroughly in hot soap suds, and dry before repacking.

Directions for Collecting Urine.—Containers are not usually supplied by laboratories for the collection of specimens of urine. The urine should always be obtained by a physician or competent nurse. Great care should be taken to clean the meatus thoroughly, and the urine should be drawn with a sterile catheter into a sterile bottle (preferably with rubber or glass stopper), with the utmost precautions to avoid contamination, and sent at once to the labora-

tory. In the case of male patients it is sometimes sufficient to collect the last half of the urine passed in the normal way after careful cleansing of the meatus. If at some distance from the laboratory the specimen should be packed in ice for transmission. In place of ice, formalin may be added in the proportion of 1 per cent by volume.

Directions for Collecting Pus.—Pus from a freshly opened abscess is to be preferred. If an old sinus exists it should be scraped with a dull curette, and the scrapings sent with as much pus as possible. Sputum outfits are convenient for the transportation of pus. But the carbolic solution should be poured out and the bottle and cork boiled before using.[1]

Directions for Collecting Pathological Tissues.—Diseased organs or parts of them may be wrapped in gauze and packed in ice, or placed unwrapped in a 5 per cent solution of formalin (1 part commercial formalin and 19 parts water).

Smears may be made directly from the sputum, pus, or sediment obtained from the urine by centrifugalization; or the material may be shaken up with an alkaline solution of sodium hypochlorite. By the latter method, sometimes called the "antiformin" method, the mucus, pus cells and ordinary bacteria are thoroughly digested; the tubercle bacilli being protected by a waxy capsule are left unchanged. The digested material is then centrifugalized and all the tubercle bacilli in the whole specimen are concentrated in a small mass, smears from which are made and stained in the usual way.

The greater accuracy of the so-called antiformin method over the ordinary method is shown in the following table which is based on the examinations of one month:

Ordinary Examinations:	
Total number of specimens examined	339
Total number of specimens positive	96
Per cent positive	28.3
Antiformin Examinations:	
Total number specimens examined	74
Total number specimens positive	8
Per cent positive	10.8
Total number of sputum specimens received during month	339

[1] The above directions are modified from the Report of the Committee on Standard Methods for the Bacteriologic Diagnosis of Tuberculosis, *Jour. Amer. Pub. Health Assoc.*, 1911, I, 273.

Positive by ordinary examination	28.3%
Pos. by combined ordinary and antiformin ex.	30.65%
Increase by combined method	2.35%

All specimens were examined by the ordinary method and only those were treated with the alkaline hypochlorite which were diagnosed tuberculosis clinically and found negative by the usual method of bacteriological examination.

The Guinea-Pig Test.—It is often desirable to inject a guinea-pig with material supposed to be tuberculous. Hence the necessity of great care in collecting specimens of urine, pus, etc., to prevent contamination. The guinea-pig is injected either intraperitoneally or subcutaneously with some of the suspected matter. If the pig does not die of the disease it is killed at the end of 6 to 8 weeks and the body examined at autopsy.

TYPHOID FEVER.

Diagnosis.—Public health laboratories are concerned with the diagnosis of typhoid fever and the discovery of typhoid bacilli carriers. The laboratory tests applicable to the diagnosis of typhoid fever are the *Widal* and *diazo reactions* and *blood cultures.* The Widal or agglutination test is the one most universally used.

Toxins.—Bacteria may be roughly divided into two great classes, namely, those which produce soluble toxins in the medium in which they grow, as, for example, the *bacillus of diphtheria,* and those which do not produce soluble toxins such as the *bacillus of typhoid fever.* The human body reacts differently to infections with organisms of these two groups. In response to infections by members of the first group, antitoxins are produced which neutralize the poisons elaborated by the infecting bacteria. Typhoid bacilli and other members of the second group, on the other hand, stimulate the formation of a variety of antibodies which act upon the bacterial cell itself, such as *bacteriolysins, agglutinins,* etc. It is upon the presence of agglutinins in the blood of a typhoid patient that the Widal test depends. The agglutinins present in the blood are specific for the organism causing the infection. Hence a similar test can be applied in the diagnosis of a number of other diseases, such as para-typhoid fever, cholera, dysentery, Malta fever, etc.

Specificity of Agglutinins.—Because of the specificity of agglutinins, the agglutination test has proved of very great value in the quick and accurate identification of bacteria. If a bacillus isolated

from a patient's stool agglutinates with a known typhoid immune serum, it is immediately recognized as *B. typhosus.*

AGGLUTINATION TEST.—The agglutinating power of a serum may be tested by either the microscopic or the macroscopic method. For the identification of unknown bacteria the latter method is preferable; for the ordinary diagnostic test the microscopic method is most generally used.

For the purpose of the Widal reaction dilutions of the patient's serum in the proportions of 1 to 20, 1 to 30, and 1 to 50 are made.[1] One loopful of these dilutions mixed on a coverslip with a loopful of a fresh broth culture make final dilutions of the serum 1 to 40, 1 to 60, and 1 to 100. When these mixtures are observed in the hanging drop under the microscope if the serum contains agglutinins, the bacilli will be seen to gradually lose their motility, to gather together into large clumps and to be drawn away from the edges of the drop. This process must be completed within 2 hours. All degrees of completeness of reaction are seen in actual practice. In a frankly positive reaction no free motile bacilli will be seen. In a definitely negative reaction there is no loss of motility and no clumping. In other instances a variable number of organisms will be seen swimming in the drop, others lying motionless and isolated, while the remainder are collected into larger or smaller clumps.

The following are the possibilities in a microscopical Widal test:

1. Loss of motility complete, agglutination complete.
2. Loss of motility complete, agglutination incomplete.
3. Loss of motility incomplete, agglutination incomplete.
4. Loss of motility absent, agglutination absent.

The first statement indicates a frank positive test and the last an equally definitive negative reaction. The second and third possibilities must be interpreted as negative, but are sufficiently "suggestive" to require the sending of blood for another test.

Macroscopic Method.—The macroscopic method requires 24 hours. The proper amount of the patient's serum is added to a suspension of typhoid bacilli in a small test tube and allowed to stand for 24 hours. At the end of this time, in a positive reaction, the bacilli will have collected into clumps which settle to the bottom of the tube in an irregular mass easily distinguishable from the even layer of sediment in the control tube which contained no serum.

[1] As a rule, only dilutions of 1 to 30 are used for routine examinations.

The fluid in the control tube will be turbid, in the other perfectly clear.

Outfits.—Each public health laboratory has its own special outfit which is furnished to physicians for collecting blood for the Widal test. These range from mica plate, aluminum or tin foil, a glass slide or a bit of filter paper on which a few drops of dried blood may be sent, to small glass bulbs in which whole blood may be obtained.

Collection of Blood.—The use of whole blood from which the serum can be separated and accurately diluted is far more accurate than the use of dried blood. For bleeding into these bulbs the following directions should be observed:

1. With clean fingers break off neatly and *squarely* the tips of *both* ends of the spindle-shaped glass bulb.

2. Cleanse lobe of patient's ear or tip of his finger with soap and water, followed by alcohol, and prick it well with a sterile needle. A *large-sized* straight Hagedorn is the best.

3. As the blood wells out, holding the tube horizontal place one end in the drop and allow the spindle-shaped bulb to fill at least one-half full. Three or four large drops will be sufficient. If too small a needle has been used the blood may not well out so freely and the finger or lobe of the ear may have to be gently "milked." *Fill the tube from one end only.*

4. When the bulb is half full seal off the empty end of the tube in the flame of a candle or match. As soon as this cools, shake the blood into the sealed end with a motion like that with which you shake down your thermometer. Then seal off the other end. *Be sure that both ends are completely sealed.*

When dried blood is used the dilutions must be made by mixing with physiological salt solution a weighed amount of the dry blood, or the dilution guessed at by mixing the blood with a sufficient salt solution to bring it to a standard shade of color. The latter method may often be grossly inaccurate, and even weighing the blood is sometimes only slightly less so.

Percentage of Positive Test.—The Widal test is positive in the first week of typhoid fever in small percentage of cases; it is positive in the second week in about 70 per cent of cases; in the third week in 95 per cent; and in a very small per cent it does not appear until the patient is convalescent. Because of this great irregularity in the appearance of the reaction a single negative result has no

diagnostic significance if taken alone. In the presence of frank clinical symptoms of typhoid fever a negative Widal test should have no weight whatever. In any obscure suspicious case in which symptoms continue for several days after a negative reaction has been obtained, another specimen should be sent for examination. The fact that the blood may contain typhoid agglutinins for weeks, months and occasionally for years after an attack of typhoid fever should be remembered in interpreting a positive Widal test. As in the case of all laboratory tests, the Widal reaction must be interpreted in connection with the clinical symptoms and physical findings in the case, and should never be made the sole basis of a diagnosis. The fact that agglutinins are present for several years after anti-typhoid inoculation should be borne in mind, and in case the patient has been so treated the Widal test is not to be relied on and a blood culture should be made.

Diazo Reaction.—Most public health laboratories test urine for Ehrlich's diazo reaction when requested to do so. This test, while not possessing the value in differential diagnosis originally ascribed to it, is of some clinical importance. When the reaction is positive, typhoid fever is to be strongly suspected. It is not infrequently positive, however, in other pathological conditions. "On the basis of this reaction, Ehrlich divided diseases into four classes: non-febrile diseases in which the test is rarely positive; febrile diseases in which it is never positive, such as acute articular rheumatism and meningitis; febrile diseases in which it may be positive, such as pneumonia, diphtheria and phthisis; and febrile diseases in which it is almost constantly positive, as measles and typhoid fever." (Emerson.) The reaction, if present at all in typhoid fever, usually appears between the middle of the first and the middle of the second weeks.

When the diazo reaction is desired, 3 or 4 ounces of urine should be sent in a clean bottle.

Blood cultures furnish the most useful method for the early diagnosis of typhoid fever. When cultures are properly made typhoid bacilli will be found in the blood during the first week of the disease in nearly 90 per cent of the cases. On account of the very exact technique required, this test cannot be made as a matter of routine in public health laboratories.

Carriers.—The examination of stools for typhoid bacilli is rarely made for diagnostic purposes except in obscure or mild

ambulant cases. They are not usually found in the stools until well into the second week, "about the time that the intestinal lesions are well advanced and ulceration is occurring." Such examinations of the stools of convalescents or of persons who have previously had typhoid fever may furnish information of very great sanitary importance. By this means alone typhoid bacilli carriers are discovered. Such persons, though perfectly well themselves, may discharge virulent typhoid bacilli for weeks, months, and even years after having the disease.

Danger of Carriers.—The importance of these healthy carriers in the spread of typhoid infection has only been recognized within the last few years. It has been estimated that from 2 to 4 per cent of all persons who have had typhoid fever continue to discharge the bacilli for more than 2 months after complete recovery. The danger of a carrier to his associates and to the general public will depend upon his occupation and his habits of personal cleanliness. Of 51 chronic bacilli carriers reported in the literature, 33 were known to have been the cause of the disease in others. Of these, 13 were dairy workers, 10 were cooks, 7 were housewives, and 3 were laundresses. Hence those "carriers" who have anything to do with the production and handling of foods, especially food which is eaten uncooked, are most dangerous. It is important to note also that about 90 per cent of all typhoid bacilli carriers are women, who, in most families, prepare the food for the table.

Stools.—The examination of stools for typhoid bacilli is difficult on account of the preponderance of other bacteria, especially colon bacilli. For such an examination, at least 1 ounce of the stool should be sent to the laboratory in a wide-mouthed sterile bottle. The longer the period of time allowed to elapse between the passage of the stool and its receipt at the laboratory, the less likely is the search for typhoid bacilli to be successful. *B. typhosus* has been isolated from stools 48 hours old.

Differential Media.—Various special media have been proposed for the purpose of differentiating *B. typhosus* from *B. Coli* and the numerous other varieties of bacteria found in the intestine. A medium first described by Endo appears to be recognized as the most satisfactory. This consists of a slightly alkaline lactose agar to which is added a solution of fuchsin and sodium sulphite. In alkaline solutions the fuchsin is decolorized by the sulphite, but regains its deep red color as soon as the solution is rendered acid.

Colon bacilli growing on Endo's medium ferment the lactose with the production of acid, hence the colonies of *B. Coli* are deep red in color. Typhoid bacilli, on the other hand, do not ferment lactose and grow as translucent colorless colonies. In searching for *B. typhosus* in stools, plates of Endo's medium are inoculated with dilutions of the fecal matter and incubated for 24 hours. Cultures are then made from a number of colorless colonies and these are identified accurately by culture or agglutination tests.

Vaccine.—A number of state and municipal laboratories, are now supplying antityphoid vaccine to physicians and health officers. This method of prophylaxis against typhoid fever has passed the stage of experiment and its use among persons in civil life will undoubtedly greatly increase.

The vaccine consists of a suspension in physiological salt solution of killed typhoid bacilli. Each dose contains from five hundred million to one billion organisms. Three injections are given at intervals of ten days. After each injection there is usually more or less reaction which may be local or general or both. In 95 per cent of the cases the reaction is no worse than the onset of a cold and is followed by prompt recovery. In less than 1 per cent of the cases, the reaction is severe and may be accompanied by fever, chills, herpes, nausea, vomiting and diarrhea. These symptoms pass off in 48 to 72 hours. The immunity produced by injections of antityphoid vaccine lasts at least 3 years; it is not known for how much longer.

Two facts should be clearly understood in connection with antityphoid vaccination. *First,* the material injected is a vaccine (bacterin) and not a serum. *Second,* that the use of this method of prophylaxis is to supplement and not supplant general sanitary measures.

MALARIA.

Diagnosis.—Practically all public health laboratories examine smears for malarial parasites. The success of such an examination depends very largely upon the thinness and evenness with which the smear is made. The official "Malaria Outfits" furnished by different laboratories consist essentially of two or more cover-glasses or microscopic slides in a container suitable for mailing. Smears should be made in the following manner:

Collection of Specimen.—After carefully cleansing the lobe of

the ear or the ball of the finger prick it with a large, sharp needle. Allow a drop of blood not larger than a pin head to collect at the site of puncture. Touch the drop with one of the cover-slips, quickly drop the other upon it and gently pull them apart without exerting pressure. *Or*, touch the drop of blood with one of the slides near its end. Place one end of the other slide in the drop and wait for a second or two until the blood has spread across the slide. Then, holding the second slide at an angle of about 30 degrees to the first, draw it gently along its surface. A thin, even smear will thus be made. The smears should be allowed to dry thoroughly in air before wrapping for mailing.

RABIES OR HYDROPHOBIA.

Because of the increasing prevalence of rabies in the United States, health officers should have a very definite understanding of certain fundamental facts in regard to the laboratory diagnosis of this disease. For it rests ultimately with the laboratory to make clear the diagnosis in any given case. The following regulations should be observed:

Animal Not To Be Killed.—1. *Do not kill a dog or other animal immediately after it bites the victim.* Shut it up and observe it for ten days. If it remains healthy during this time, this is absolute proof that the animal was not suffering from rabies, and the human victim is in no danger of developing the disease. If the animal shows signs of illness either allow it to die naturally or kill it after three or four days. The bite of a dog is infectious from 1 to 5 days before symptoms develop and before Negri bodies become sufficiently large and numerous to be found on microscopic examination. For this reason the animal should be allowed to live until the disease has become well developed.

2. *Do not shoot the animal in the head.* If the brain is not completely blown out of the head by so doing it may be so badly damaged that satisfactory examination is impossible.

3. *Send the whole head to the laboratory,* well packed in ice in a water-tight container. If the head is not kept on ice the brain may become so soft that its parts cannot be recognized. This will greatly hinder satisfactory examination.

Examination.—When the head is received at the laboratory the brain and Gasserian ganglion are removed from the skull. The brain is opened, a small piece of the hippocampus major (Ammon's

horn) is removed, pressed between two glass slides and smears made on several slides. These are stained by any one of a variety of methods and examined with the oil immersion lens. Negri bodies, if present, will be found as round or oval granular bodies inside the large ganglion cells. If these are not found a guinea-pig is injected subdurally with an emulsion of the suspected brain. It requires, as a rule, from 10 to 18 days for symptoms to show themselves in a guinea-pig inoculated with the brain of a rabid animal. In rare instances the incubation period may be longer than three weeks.

NEGRI BODIES.—Negri bodies were first described by the Italian, Negri, of the University of Pavia, in 1903. Search for them furnishes the most rapid and satisfactory means of diagnosing rabies. In general, they are most easily found in the brains of animals allowed to die in the natural cause of the disease, and are more difficult to find the earlier in the course of the disease the animal is killed.

The finding of Negri bodies is now very generally recognized as practically conclusive evidence of the existence of rabies. This has been confirmed by numerous observations. Luzanni reports 459 examinations controlled by the injection of guinea-pigs. 297 cases were positive by the biologic test, only 9 of which failed to show Negri bodies. Not one of those which failed to kill a guinea-pig showed the bodies. Poor collected 550 similarly controlled cases from the records of 6 European laboratories. Of these, 344 showed Negri bodies and all were positive by the guinea-pig test; while of 206 which showed no Negri bodies, 11 were found positive by the guinea-pig test. Hence, while the presence of Negri bodies in the brain of an animal amounts to proof of the existence of bodies, "in failure to find them there is a possibility of error equal to 5 per cent." [1]

Sections are made of the Gasserian ganglion and stained in the ordinary way. These are then examined for round cell infiltration and pericellular endothelial proliferation with destruction of the ganglion cells, conditions found with considerable regularity in rabies.

[1] September, 1913, Noguchi is reported to have cultivated successfully the microbe of rabies, which is a protozoön having a stage so minute as to permit it to pass through a porcelain filter.

VENEREAL DISEASES.

The ignorance of prudery in regard to venereal diseases is rapidly giving place to knowledge which sets the true value upon these social plagues. It is being recognized by the general public, by men particularly, that the latent forms of these diseases, though capable of ruining innocent lives, are exceedingly difficult to diagnose clinically and that certain laboratory tests are the most reliable means of detecting them. The demand upon public health laboratories for such tests will, therefore, undoubtedly continue to increase.

1. **Gonorrhea.**—Specimens.—In order to secure satisfactory examinations for gonococci it is essential that the specimens be properly secured and prepared. Not only pus from the urethra should be examined, but, before a male patient is dismissed as cured, material "milked" from the prostate gland and seminal vesicles should be proved free from gonococci on several consecutive examinations.

Cover-glasses and slides containing gonorrheal pus should never be left sticking together. This is the condition in which many specimens of this kind are received at laboratories. Such a specimen will dry around the edges and the pus cells in the central portion of the "moist chamber" thus formed soon become so macerated that satisfactory examination is impossible. Contaminating bacteria will multiply to such an extent that any gonococci that may be present will be obscured.

Contaminations.—Pus from a chronic vaginitis always contains contaminating bacteria in such enormous numbers that the detection of gonococci in such specimens is rendered difficult if not impossible. In such cases smears should be made from any pus that can be pressed from the urethra, or taken from the external os of the uterus. It will often help matters to reduce the excessive bacterial flora of the vagina by means of antiseptic douches applied for several days before taking the specimen.

Reports.—The report from the laboratory may show that a given specimen was either positive, negative, doubtful or unsatisfactory.

A "positive" report can mean but one thing, namely, that the pus contained gonococci and that the patient has gonorrhea.

A negative report has not the definite value of a positive finding.

Two or more consecutive negative results should be obtained before being accepted at their face value.

A diagnosis of "doubtful" is all that can be justly made in many cases, especially on specimens of vaginal smears. Gram negative diplococci other than gonococci are sometimes found in urethral and vaginal smears. These "pseudogonococci" may sometimes be seen inside of leucocytes. They do not occur in as great numbers, either intra- or extra-cellularly, as do gonococci in acute and sub-acute gonorrheal infections. It is in the chronic and latent cases that they cause the most confusion. More specimens should always be sent from such cases.

An unsatisfactory specimen calls for another smear from the same case.

Vaginal Pus.—Gonorrheal infections are by no means uncommon in young girls from 1 to 10 years of age. A very satisfactory method of obtaining specimens from such cases is as follows: Boil an ordinary medicine dropper in water for several minutes. Draw a few drops of the boiled water into the dropper and when cool insert the tip of the dropper into the vaginal orifice, gently expel the water into the vagina and draw it again into the dropper. Any pus in the vagina may thus be easily obtained for smears.

2. **Syphilis.**—The methods of laboratory diagnosis of syphilis consist of the Wassermann test and examinations for *Treponema pallidum*.

Wassermann Test.—Very few public health laboratories in the United States make the Wassermann test. The impossibility of obtaining suitable specimens of blood from any large proportion of the physicians of a state renders the doing of this test out of the question for state laboratories. The principle upon which the test is based may be briefly stated: In the presence of its antigen an immune serum has the power of absorbing complement so that if, after allowing time for the fixation of the complement, hemolytic serum and the corresponding red blood cells are added to the mixture, no hemolysis takes place because there is no free complement remaining. Thus, if a patient's serum be mixed with syphilitic antigen (e.g., extract of syphilitic liver) and complement (fresh guinea-pig serum) and allowed to stand for a time and then a hemolytic serum and the corresponding red blood cells be added, the occurrence of hemolysis will depend upon whether the patient had syphilis. If he did have lues his serum and the antigen will

combine with the complement and no hemolysis will occur. If he did not have syphilis, his serum and the antigen will not combine with the complement which will be left free to cause hemolysis when the hemolytic serum and red blood cells are added.

Specimens for Wassermann Test.—Since the test depends entirely upon the occurrence or non-occurrence of hemolysis it is evident that clear colorless serum must be used. The amount of each ingredient of the test must be measured with the greatest accuracy. Dried blood is therefore of absolutely no value for the tests. At least 2 c.c. of blood, preferably more, must be obtained. This is best taken from a vein at the bend of the elbow. The blood is allowed to clot and the clear serum which soon separates may be sent to the laboratory in a sterile tube.

When a specimen of blood-serum is sent for the Wassermann test some facts concerning the personal habits of the patient should accompany it. This will aid in interpreting the result inasmuch as the test may be modified by a number of factors. Thus, alcohol taken in considerable quantities will render the strongest positive serum negative.

Examinations for Treponema (Spirochæta).—Examinations for Treponema pallidum are much more practicable for public health laboratories especially for state laboratories. The success of such examination depends very largely upon the manner in which the specimen has been taken. Treponemas may be found in stained smears or by means of the dark ground illuminator.

In securing a specimen to be examined for Treponema pallidum two facts should be remembered. First, the superficial portion of the discharge from a chancre or mucous patch is always contaminated by innumerable bacteria. Second, the Treponema pallidum is a strictly anærobic organism and is practically never found on the surface next the air. To secure a satisfactory specimen the superficial crusts or secretions must be gently removed without causing bleeding, and the surface irritated gently with a sterile swab until serum exudes. In a true syphilitic lesion the serum brings with it from the deeper tissues large numbers of Treponemas. The serum may be collected in spindle-shaped bulbs, such as are used by some laboratories for taking blood for the Widal test; or it may be smeared on slides or cover-glasses and allowed to dry thoroughly in air before being sent to the laboratory. Failure to

find Treponema pallidum in a single specimen should never be considered equivalent to a negative clinical diagnosis of syphilis.

MENINGITIS.

Diagnosis.—Public health laboratories are frequently called upon to examine cerebrospinal fluid for meningococci. In state laboratories this work is not very satisfactory because of the readiness with which meningococci undergo bacteriolysis in the fluid after withdrawal. To obviate the difficulties as much as possible, the physician or health officer should make smears from the fluid upon slides at the bedside, and make cultures on Löffler's blood serum if available, as well as send some of the fluid to the laboratory in a sterile bottle.

The Minnesota State Board of Health supplies a complete outfit sterilized and ready for use for making spinal punctures in cases of meningitis or poliomyelitis.

APPENDIX.

SCHEMES FOR SANITARY SURVEY OF CITIES, PUBLIC BUILDINGS AND SCHOOLS.

SCHEDULE FOR SANITARY SURVEYS OF CITIES.[1]

A. Location, Population, and Climate:

Name of city........county........and State....................
Location........latitude........and longitude....................
Area of city............. ....
When was city founded?..
When was it incorporated?.......................................
Give population according to U. S. census in........1860........
1870.........1880.........1890.........1900........1910........
Present (estimated)..
What is the density of population?.............................
What is the estimated population under five years of age?...........
Give population according to whether native or foreign born?........
according to whether white or colored?.........................
What is the number of dwelling houses of the city?................
What is the average number of persons to each dwelling?............
Have meteorological observations been kept regularly in the city?.....
Who made the observations?........Have they been published?......

B. Topography and Geology:

Altitude of city?........on what authority?.....................
Give highest and lowest elevations?..............................
Is the surrounding country level or hilly?........................
Are there any marshes, lowlands, or swamps near city?..............
State if any of the city land is filled or made land?.................
Are there any mountains near city; if so, what is the altitude?.......
Is the site of the city level?........hilly?.........................
Are there any covered up watercourses in the city?.................
Have any original watercourses been diverted from their course, or modified? ....
State if there are any ponds or other stagnant water?................
What is the distance of the city from tide-water?...................
State the character of the soil and of the subsoil?..................
Describe any rivers, lakes or canals in the city limits?..............
Are they affected at all by the tides?.............................
Is the water of the streams clean or foul?.........................

[1] Gerhard: Guide to Sanitary Inspection — John Wiley & Sons, 1909.

Does any foul surface drainage or sewage enter any of the streams?..
Is any part of the city subject to overflows, and to what degree?.....
To what geological formation does the site of the city and vicinity belong? ....
What are the underlying geological strata?..........................
Are they permeable or impermeable to water?.........................
Does the disturbance of the soil cause malaria?.....................

C. Water-Supply:

Describe the sources of water-supply for the city...................
Describe the character and degree of purity of the supply...........
Give chemical and bacteriological analyses if obtainable............
What are the physical characteristics of the water-supply?..........
What is the distance from the source of supply to the city?.........
Gravity conduits?........Pumping?...................................
State capacity of the conduit?........of the pumps?.................
How many reservoirs are there?......................................
State capacity of each........its location........elevation..........
Do the waterworks comprise filtration works?........................
What is the average consumption in million gallons per day?........
What is the maximum consumption?....................................
What is the average daily consumption per capita?...................
What is the average water pressure in the city?.....................
What is the maximum?..
How many fire hydrants does the city have?..........................
How many public fountains?..
How many house connections or taps?.................................
Are the house services metered generally........or what is the proportion of metered to unmetered taps?..........................
To what extent, if any, is cistern or well water used in the city?......
What is the average depth of the wells?.............................
Are the wells dug, driven, drilled or bored?........................
Are there any artesian wells in the city?...........................
Has the use of well-water caused any sickness?......................
How many public baths?........What kind and type?....................
What is the average daily water consumption of the bath houses?....

D. Drainage and Sewerage:

What is the proportion of closely built-up area compared with the open or suburban area?...
What is the character of the surface drainage?......................
Is any subsoil drainage provided?........How is it arranged?........
Are cellars in any part of the city subject to overflow or flooding during or after heavy rainstorms?..............................
Does the city have a regular system of sewerage?....................
Furnish sewerage map..
Is the city sewered on the combined system?........on the separate system?........or on a combination of both?......................

Give the mileage of sewers.................................
Give number of sewer outfalls.................................
State their size.................................
Where do the sewer outfalls discharge?.................................
Are the city sewers self-cleansing?.................................
Are flush tanks used?.................................
What proportion of the area of the city lacks sewerage?.............
State the number of house connections?.................................
Describe the manner in which the house connections are made in the street? ....
How are the street sewers ventilated?.................................
Is the plumbing and drainage work in the houses governed by rules and regulations?.................................
Are the sewer connections compulsory where a street has been sewered?
Are any cesspools tolerated?........If so, how are they constructed?..
Describe any other methods of disposal of the waste liquids from houses? ....
Is there any regular system of sewage disposal?.....................
What system of sewage disposal is in use?.........................
Describe its chief features?.................................
Are any odors ever noticed from the sewer openings?................
Are odors perceptible at the sewage purification works?..............

E. Streets and Public Grounds:

Give the total number of miles of streets?.........................
State how many miles are paved with granite stones?................
With asphalt?.................................
With macadam?.................................
With cobble-stones?.................................
With wood?.................................
With asphalt paving-blocks?.................................
With any other artificial pavements?.................................
What is the usual width of the streets?.................................
What is the width of the sidewalks?........How are they finished?...
Are the streets regularly cleaned by the city?.....................
Are they sprinkled in summer?.................................
Is the street cleaning method satisfactory?.........................
Is hand labor used exclusively?.................................
Are any sweeping-machines used?.................................
Are shade trees planted along the streets?.........................
What kind?........How arranged?.................................
Does the asphalt pavement injure the trees?.........................
Are the trees unfavorably affected by leakage from gas mains?........
Who cares for the trees in the streets?.............................
State number and area of all public parks?.........................
How many smaller open squares are within the city limits?..........
Are there any grade crossings in the city?.........................
How many lives lost annually by them?.............................

Is there a municipal street railway system, or are the lines owned by private companies or corporations?...
How many companies are there?...
What system of electric traction is used?...................................
State number of accidents on trolley lines per year.........................

F. Habitations and their Tenants:

How many dwelling-houses are there in the city?.............................
How many office buildings?........How many factory buildings?...
How many public buildings?..
What proportion of dwellings is occupied by the owners?.....................
How many tenement-houses are in the city?...................................
What is the average number of persons to a dwelling?........................
Does the city have a building department?...................................
Are there any building regulations?...
Are the rules enforced, and is there a regular system of inspection?...
How many dwellings are connected with the sewers?...........................
How many houses are connected with the water mains?.........................
Do any houses use wells, springs, or rain-water cisterns for supply?...
How many detached buildings?........How many houses in blocks?..
Do any of the houses have damp or wet cellars?..............................
Are the floors of the cellars cemented?.....................................
What is the usual height of the dwelling-houses?............................
How many houses in city are without bathtub?................................
How are the yards kept?...

G. Lighting:

Is the city lighted by gas?...
Is the city lighted by gas and electric lights?.............................
Describe the location of the gas works?.....................................
Is the gas plant owned by a private corporation or by the city?......
How many miles of gas street mains?...
What kind of gas is supplied to the users?..................................
What is the price charged per 1000 cubic feet of gas?.......................
Is the quality of gas supplied satisfactory?................................
Is it tested by municipal inspectors or gas-testers?........................
What proportion of dwelling-houses are supplied with gas?...................
How many gas accidents have occurred within a year?.........................
Is the city lighted up by electric light?...................................
Who owns the electric light works?..
Municipal or private plant?...
What is the capacity of the plant?..
What is the price charged for electricity, for lighting?....................
What is the price charged for electric current for power purposes?....
Are streets, squares and parks lighted by electricity?......................
Which is the better system of street lighting, gas or electric?........
How many electric lamps are there in the streets?...........................

How many accidents have occurred in a year from the use of the electric current?..
Other modes of lighting?........oil in lamps........gasoline lamps.
Is there any acetylene lighting plant?..............................

H. Garbage and Refuse Disposal:

Is the household garbage removed by the municipality?..............
Is it removed at private expense?....................................
How often is the garbage removed?........How often the ashes?.....
Is garbage removed in covered vessels or carts?.....................
Are ashes and garbage kept separate by ordinance?..................
What is the cost per annum of the removal?.........................
Where are the ashes disposed of?.....................................
What is done with the garbage?......................................
Any reduction plants?...
Any refuse destructors?...
Do large hotels and department stores have their separate refuse destructors? ....
Which city department takes care of the removal of dead animals?....
How are the carcasses disposed of?..................................
Is the work done satisfactorily?....................................
Are any houses still served with cesspools?........If so, what proportion? ....
What is the construction of these cesspools?........leaching?........ water-tight? ....
Are any cesspools with overflows to sewers permitted?................
Are there municipal rules regarding the construction of cesspools?....
How often are the cesspools cleaned out?...........................
Are the methods pursued satisfactory?...............................
Are there any privy vaults attached to houses?.....................
How many?...
Where are the vaults located?..
Are there any municipal rules regarding the construction of the vaults? ....

I. Markets:

How many public markets does the city have?.......................
What is the size and area of each of them?.........................
Where are the markets located?......................................
How many buildings does each market contain?......................
Describe construction and arrangement of the markets?..............
Are the market stalls rented by the city?...........................
What is the average rental per year?................................
On how many days of the week are the markets open?...............
Are the markets kept in a cleanly and sanitary condition?...........
What are the rules in force regarding the cleaning of the buildings?..
How often are the markets inspected and by whom?...................
What are the principal transportation routes for the fresh food supplies brought to the markets?..................................

J. Slaughter-houses:

How many slaughter-houses are located in the city?..................
Are they built by the municipality or by private owners?............
Are there municipal rules and regulations in force regarding the slaughter-houses? ....
What is the location of slaughter-houses with reference to the city plan? ....
What is the condition of the water supply and sewerage of the buildings? ....
What is the mode of killing the animals?.........................
What is done with the offal?.......................................
Is any nuisance to the neighborhood caused by the slaughter-houses?..
What is the average annual number of animals slaughtered at the abattoirs?........Of each kind?................................
Is there any fat rendering establishment at the abattoir?............
How are the noxious gases from the same disposed of?.............
Are private slaughter-houses permitted in the city?..................
What is the average annual rental of the slaughtering stalls to butchers? ....
Is there any official meat inspection at the abattoir?................
Is there a cold-storage plant connected with the abattoir?............

K. Manufactures and Trades:

Are there located within the city limits any manufacturing establishments which constitute a nuisance?.............................
Do any of the factories pollute the water-courses?...................
Do any of the manufacturing establishments create offense to the public by being unduly noisy?.....................................
What are the hours of labor?...
Is there any factory inspection law?........Is it enforced?..........
How is the ventilation of the factories?...........................

L. School-houses:

How many public schools are there in the city?......................
Where are they located?...
State for each of the schools the following:
Location........altitude and area of site........nature of soil...... drainage........date of erection........cost of building........ Number of stories........number of rooms........number of pupils ....
(See special school schedule for the following subjects:)
Material of construction........heating apparatus........ventilation system........daylight lighting........artificial light........ cloak-rooms........basement........playrooms........toilets..... ....water supply........drinking-fountains........hours of study.
Is there a medical inspection of the school?........................
Are school baths installed?...

What are the results obtained with them?........................
Do the schools have a gymnasium?........Do they have playgrounds?
Are the water closets located within or without the buildings?........

L. Public Libraries, Museums, Art Galleries:

Is there any public library in the city?........How is it maintained?
How many volumes has it?..
Is there any public museum or art-gallery?.......................

M. Theatres, Churches, Amusement Halls, and other Public Buildings:

(For these see special schedules.)

N. Hospitals:

(For these see also the special schedule.)
State the number of hospitals in the city?.........................
Give their location with reference to the city plan?...................
How many patients do each accommodate?..........................
How many physicians are employed?...............................
Does the hospital have an ambulance service?......................
Are any of the hospitals over-crowded?............................

O. Prisons, Jails, and Police Stations:

How many policemen are on the force?.............................
Do some of them act as sanitary inspectors?........................
How many police stations are there?..............................
How many prisoners' cells in each?...............................
What is the sanitary condition of the police cells?...................
What is the average daily number of prisoners?....................
Are the prison cells well ventilated?..............................
Are there water-closets in the cells?..............................
Where are the lavatories located?.................................
Are there any spray baths for the prisoners?.......................
How are the police cells heated?..................................
Is there a police matron?........Is there a police surgeon?..........
Have there been any outbreaks of epidemic diseases in the prisons?....
How are the prison inmates occupied?.............................
What is the estimated number of prostitutes?......................
How many drinking-saloons are there in the city?..................
Are there any dance halls?..
How many cases of drunkenness are brought before the police courts per year?..

P. Public and People's Bath-houses:

Is there a municipal system of public baths?.......................
How many public bath-houses does the city have?...................
Where are they located?........What was their cost?...............
How many bath units in each bath-house?..........................

What is the prevailing form of bath?............................
Tub baths?........Spray or rain baths?..........................
Are any swimming-pools connected with the public baths?............
Do the swimming-pools have cleansing baths?.......................
If city is located on a river, lake or the ocean, how many floating municipal bath establishments are there?........................
Are the city bath-houses self-supporting?..........................
Is any admission fee charged?........If so, how much?..............

Q. Fire Department:

Is there a municipal paid fire department?........................
Is the fire service performed by volunteers?.......................
How many fire and engine-house stations are there in the city?........
Does the fire department control the construction of buildings?.......
How many steam fire-engines does the city own?.....................
How many hook and ladder companies?...........................
Is the water supply for fire purposes satisfactory?.................
If the city is on a river, lake or harbor, are there city fire-boats?......
Is there an auxiliary high-pressure system?........................
Is salt-water used for fire extinguishing purposes?..................
How many firemen are employed in the fire department?.............
Is there an insurance patrol service for saving property?............
What is the annual number of fires?..............................
What is the average annual property loss by fire?....................
What is the annual loss of lives by fire?...........................
What are the chief causes of fire?.................................
How many fire alarm boxes has the city?..........................

R. Public Parks and Boulevards:

What is the total acreage of public parks?.........................
Where are they located?..
Are public parks and squares kept in good condition?................
Are there any comfort stations in the parks and squares?............
How many?........What is their condition?........Who maintains them? ....

S. Cemeteries and Modes of Burial:

Are there any cemeteries within the city limits?.....................
State total number of cemeteries near the city?.....................
Are they private concerns or municipal?...........................
State location of cemeteries?....................................
Describe soil in the cemeteries...................................
Is it well and thoroughly underdrained?...........................
What is the usual average depth of the graves?.....................
What is the number of burials per year?...........................
Are all the burials recorded in the health office?....................
Are other modes of burials permitted or practised?..................

T. Public Health Laws and Ordinances.

U. Vital Statistics of the City:

Are births and deaths recorded?....................................
What is the annual number of deaths? ....
What is the annual number of births? ....
What is the birth rate?..
What is the death rate?..
What is the average increase per annum in population of the city?..

V. Diseases of the Year and Epidemics.

W. Disinfection:

Does the city have a municipal disinfecting station?..................
Who operates the plant and under whose control is the same?........
Where is it located?..
What method of disinfection is practised?..........................
Are houses in which epidemic diseases occurred disinfected before any new tenants move in?......................................
At whose expense is the disinfection done?..........................

X. Municipal Sanitary Expenses:

Total annual appropriation:
For sanitary purposes?..
For sewerage and drainage purposes?...............................
For street paving?..
For street cleaning?..
For removal of garbage and ashes?.................................
For care of markets?..
For municipal abattoirs?..
For care of public parks and fountains?...........................
For public comfort stations?......................................
For lighting? ....
For fire department services?.....................................
For police department services?...................................
For building department services?.................................

SCHOOL-HOUSES.[1]

1. Building, how located as to elevation and drainage?....................
2. Size of house?..
3. Is it brick or wood?..
4. Has it a cellar or basement?..
5. If so, state its condition—whether wet, damp, dirty, dark, unventilated, cemented, or floored, etc.?..

[1] From New Jersey State Board of Health's Inspector's Guide.

6. Size of school-room?........Give number, length, breadth, and height, that the cubic space may be computed?...........................
7. Is there an entry?...
8. Is room wainscoted?........Kind of wall?...................
9. Number of doors?...
10. How many windows?..
11. Size of windows and glass?.................................
12. Correct answers are necessary to ascertain lighting surface..............
13. Distance from ceiling?...
14. Are the windows to the right or left, behind or in front of the scholars?..
15. What is the size of the yard?..................................
16. Is it fenced?...
17. Does water ever stand in the yard or beneath the house?................
18. Is it well heated, and how?........Is there dust?........Is water supplied to stove or furnace?......................................
19. Do you register by thermometer?........Is temperature even?..........
20. Is it well ventilated, and how?........If by ventilating registers state whether they are in the ceiling overhead, or in flues at bottom or top of room, or both........Also, if there is any provision for allowing fresh air to enter the room?......................................
21. If by windows, have you any ways of preventing draught?..............
22. Are the blackboards placed between the windows?......................
23. Blackboards, if possible, should be on the side where there are no windows, on account of less reflection of light..........................
24. Are the surfaces in good condition?...................................
25. What is the source of water-supply?...................................
26. If from wells, give depth........Is there any privy vault, stable sink-drain, or cesspool near?........See diagram, and mark as nearly as possible. the distance in feet from such sources of pollution..........
27. Is the well protected from all surface pollution?.......................
28. Is the condition of the well carefully looked after?......................
29. Are there two privies belonging to the school-house?....................
30. How many feet from school-house?......................................
31. Are the buildings kept in good order?...................................
32. Have they vaults?...
33. How often cleansed or disinfected?......................................
34. How is it done?...
35. Do trustees or others inspect buildings and school monthly?.............
36. Have you a janitor?..
37. If water-closets are in use, in what condition are they kept?............
38. Are they always flushed with an abundance of water?.................
39. Are they odorless?...
40. Are there any offensive or dangerous nuisances near the school-house, such as barnyards, slaughter-houses, stagnant pools, etc.?............
41. Is the law providing for vaccination attended to?.......................
42. Are pupils from families, where infectious or contagious diseases are prevailing, excluded from school?......................................
43. Are all the doors hung to swing outward, as the law requires?...........

44. In what year was the school-house built?...........................
45. Is it a suitable house for the district?........If not, state reason why ....Has it proper places for hanging garments, hats, etc.?........
46. Are the seats and desks fitted to the size of the scholars?...............
47. How many pupils can be comfortably seated in the building?.............
48. Is any room too crowded?...
49. What is thus far the average daily attendance this quarter?............
50. How many of your pupils are near sighted?.........................
51. Have you known pupils to become near-sighted while attending school?...
52. Are there curtains, or inside or outside blinds, to the windows?..........
53. How and to what extent is either physiology or hygiene taught?.........
54. Is there provision for hand- and face-washing?.......................
55. General remarks as to needed improvements..........................

INSPECTION SCHEDULE RELATING TO HOSPITALS.[1]

.....................................Hospital, at........................

1. Date of examination...
2. Location ....
3. Area of grounds and altitude above sea level.........................
4. Character of soil..
5. Arrangement of drainage...
6. Are sewers connected with drains?.................................
7. How are sewers ventilated?...
8. Grease traps?..
9. How are the grounds improved, trees, etc.?..........................
10. General character of buildings....................................
11. Material of construction..
12. Date of erection..
13. Cost of buildings...
14. Number of beds for patients.......................................
15. Wards, general character, number..................................
16. How many patients in a ward?.....................................
17. Floor area per bed..
18. Cubic space per bed? ....
19. Ward floors...
20. Ward walls..
21. Ward windows.......................   ....
22. Ward doors and blinds...
23. Ward heating ....
24. Ward ventilation..
25. Ward waterclosets...
26. Urinals, slopsinks..
27. Ward baths..
28. Special baths...
29. Portable baths..

[1] From reports of New Jersey State Board of Health.

30. Lavatories, separate from baths?
31. Ward kitchens
32. Ward dining-rooms
33. Ward furniture
34. Bedsteads
35. Mattresses
36. Tables
37. Chairs
38. Spittoons
39. Medicine-trays
40. Bells
41. Patients' clothing, how cared for?
42. How registered
43. Ward physicians' rooms
44. Ward nurses' rooms
45. Special rooms or small wards connected with wards
46. Nurses' duties
47. Other ward attendants
48. Main administration building
49. Main office
50. Visitors' reception rooms
51. Rooms of president, physicians, and employees
52. Main kitchen
53. Kitchen furniture
54. Food storerooms
55. Laundry
56. Laundry appliances
57. Number of laundresses
58. Laundry records and registers
59. Washing for employees
60. Linen closets
61. Mending
62. Mattress rooms
63. Disinfection apparatus
64. Central bathing establishment
65. Dead house
66. Amphitheatre
67. Out-door patients' dispensary
68. Number treated per year
69. Cost
70. Dispensary and pharmacy
71. Lifts
72. Number of days' treatment of patients yearly
73. Total annual cost
74. Daily cost per patient
75. Annual cost of employees
76. Annual cost of repairs
77. Annual cost of fuel and quantity

78. Annual cost of medicines and apparatus..............................
79. Annual cost of food..
80. How is the hospital governed?....................................
81. How are the governors or trustees appointed?.......................
82. Superintendent: Duties, pay, how appointed?.......................
83. Nurses: Male, duties, how appointed, pay?.........................
84. Cooks ....
85. Porters ....
86. Stewards ....
87. Clerks ....
88. Matron ....
89. Nurses, female..
90. Rules for admission of patients...................................
91. Place and mode of admission......................................
92. Rules for conduct of patients.....................................
93. Registration of patients...
94. Registration of diseases...
95. Registration of beds...
96. Diet forms..
97. Permits to go out...
98. Rules for visitors...
99. Special wards...

Indiana State Board of Health

DEPARTMENT OF FOOD AND DRUGS

SANITARY INSPECTION OF DAIRIES.

DAIRY SCORE CARD.

Owner or lessee of farm...

P. O. Address.............................. County.....................

Total number of Cows.................. Number milking.................

Gallons of milk produced daily..

Product is retailed by producer in.......................................

Sold at wholesale to..

For milk supply of..

Permit No............... Date of inspection......................, 19.....

REMARKS ....

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(Signed).......................................

Inspector.

(FRONT VIEW)

DETAILED SCORE.

EQUIPMENT.	SCORE Perfect.	SCORE Allowed.
COWS.		
Health	6	...
Apparently in good health.... 1		...
If tested with tuberculin once a year and no tuberculosis is found, or if tested once in six months and all reacting animals removed.............. 5		
(If tested only once a year and reacting animals found and removed, 2.)		
Comfort	2	...
Bedding 1		
Temperature of stable........ 1		
Food (clean and wholesome).....	2	...
Water	2	...
Clean and fresh 1		
Convenient and abundant..... 1		
STABLES.		
Location of stable..............	2	...
Well drained 1		
Free from contaminating surroundings 1		
Construction of stable...........	4	...
Tight, sound floor and proper gutter 2		
Smooth, tight walls and ceiling 1		
Proper stall, tie and manger.. 1		
Light: Four sq. ft. of glass per cow	4	...
(Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft., 1. Deduct for uneven distribution.)		
Ventilation: Automatic system....	3	...
(Adjustable windows, 1.)		
Cubic feet of space for cow: 500 to 1,000 feet................	3	...
(Less than 500 feet, 2; less than 400 feet, 1; less than 300 feet, 0; over 1,000 feet, 0.)		
UTENSILS.		
Construction and condition of utensils	1	...
Water for cleaning..............	1	...
(Clean, convenient, and abundant.)		
Small-top milking pail..........	3	...
Facilities for hot water or steam..	1	...
(Should be in milk house, not in kitchen.)		
Milk cooler......................	1	...
Clean milking suits.............	1	...
MILK ROOM.		
Location of milk room..........	2	...
Free from contaminating surroundings 1		
Convenient 1		
Construction of milk room.......	2	...
Floor, walls, and ceiling...... 1		
Light, ventilation, screens.... 1		
Total	40	...

METHODS.	SCORE Perfect.	SCORE Allowed.
COWS.		
Cleanliness of cows............	8	...
STABLES.		
Cleanliness of stables...........	6	...
Floor 2		
Walls 1		
Ceiling and ledges.......... 1		
Mangers and partitions....... 1		
Windows 1		
Stable air at milking time.......	6	...
Barnyard clean and well drained.	2	...
Removal of manure daily to field or proper pit................	2	...
(To 50 feet from stable, 1.)		
MILK ROOM.		
Cleanliness of milk room........	3	...
UTENSILS AND MILKING.		
Care and cleanliness of utensils..	8	...
Thoroughly washed and sterilized in live steam for 30 minutes 5		
(Thoroughly washed and placed over steam jet, 4; thoroughly washed and scalded with boiling water, 3; thoroughly washed, not scalded, 2.)		
Inverted in pure air......... 3		
Cleanliness of milking..........	9	...
Clean, dry hands............ 3		
Udders washed and dried.... 6		
(Udders cleaned with moist cloth, 4; cleaned with dry cloth at least 15 minutes before milking, 1.)		
HANDLING THE MILK.		
Cleanliness of attendants........	1	...
Milk removed immediately from stable	2	...
Prompt cooling (cooled immediately after milking each cow)..	2	...
Efficient cooling; below 50° F....	5	...
(51° to 55°, 4; 56° to 60°, 2.)		
Storage; below 50° F...........	3	...
51° to 55°, 2; 56° to 60°, 1.)		
Transportation; iced in summer..	3	
(For jacket or wet blanket allow 2; dry blanket or covered wagon, 1.)		
Total	60	...

Score for equipment........ + Score for methods........ = ...*Final score.*

NOTE 1.—If any filthy condition is found, particularly dirty utensils, the total score shall be limited to 49.

NOTE 2.—If the water is exposed to dangerous contamination or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

(BACK VIEW)

INDEX.

INDEX.

A

D

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S

ABBREVIATIONS USED.

c.c.—Cubic centimeter.
c.m.—Cubic millimeter.
mi.—Micron, 1/1000 of a millimeter.